Vol. I JANUARY, 1920 No. 10

THE PAPER INDUSTRY

The Monthly Educational Journal of the Paper Industry

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Philadelphia, Pa., U. S. A.

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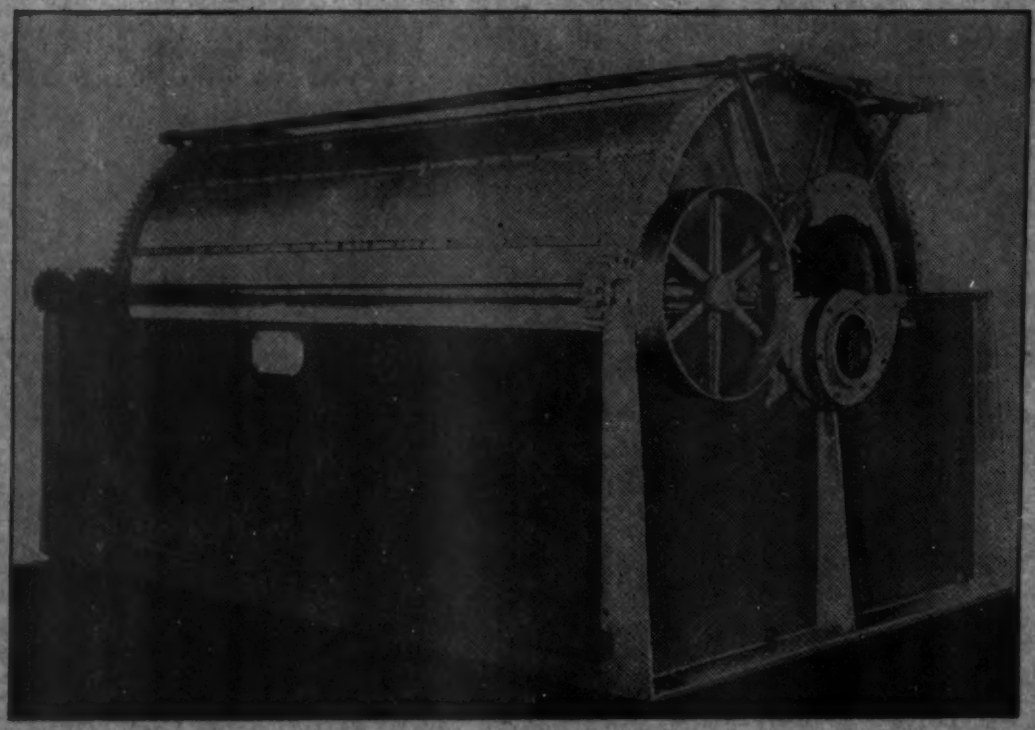

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The Unkle Improved Extractor

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It's a Bear on Ground Wood in laps, Frozen Ground Wood, in fact, no mill using Ground Wood in any quantity can afford to be without it.

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The Griley-Unkle Engineering Co.

210 Central Building **FORT WAYNE, INDIANA**

Vol. 1—No. 10

THE PAPER INDUSTRY

PETER J. MASSEY
Editor

A MONTHLY EDUCATIONAL JOURNAL
Devoted to the Interests of The Paper Industry

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WOOD PULP

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SOLE AGENTS in the United States, Canada, Mexico and Cuba for

Finnish Cellulose Union, Helsingfors, Finland

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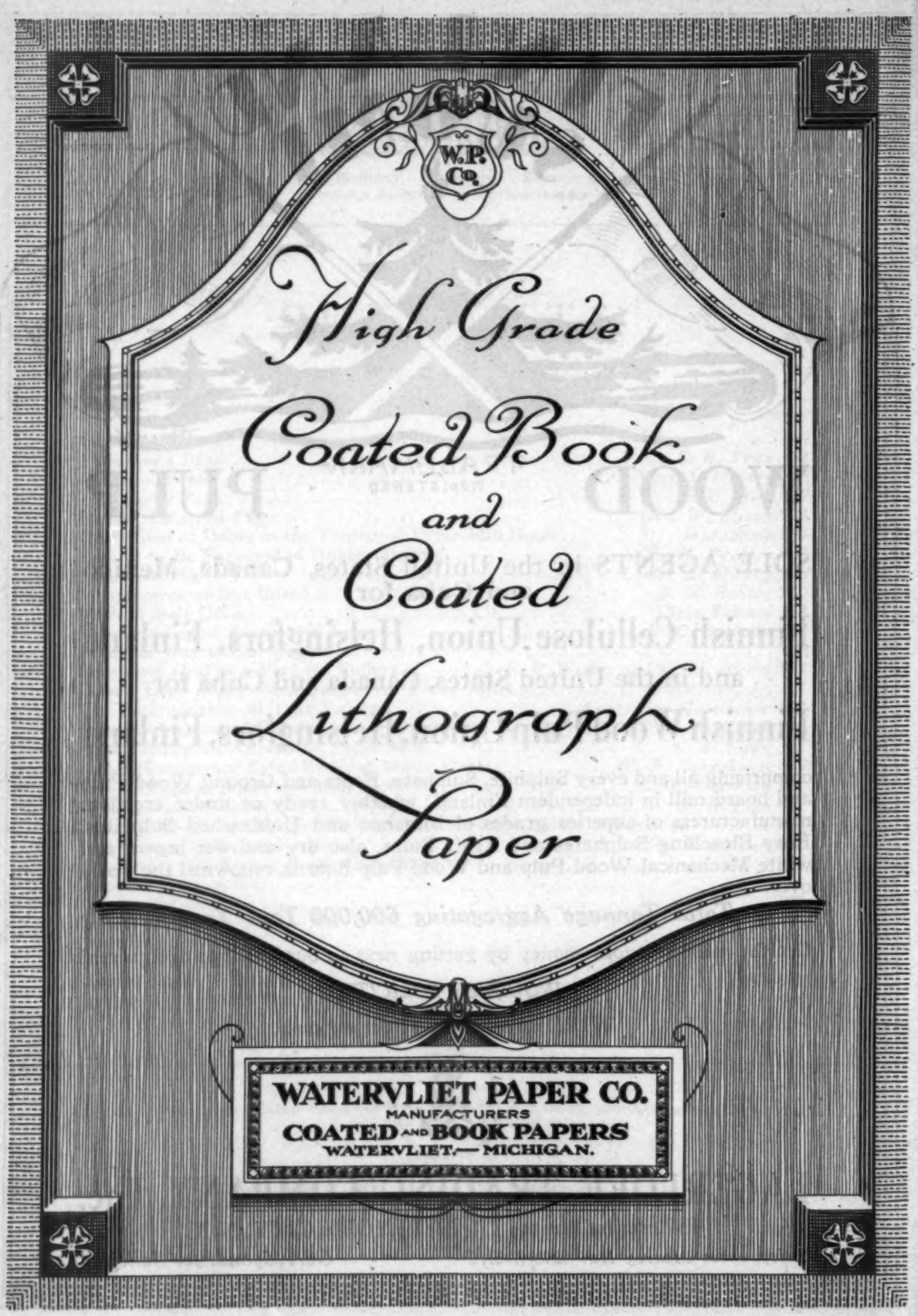
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Paper
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WATERVLIET,— MICHIGAN.

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Elite	" "	Silverleaf	Coated Bond
Velvet	" "	Opacity,	English Finish
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These Wayne tanks and pumps are fire-proof. It's a great insurance move to have Wayne storage for oil (or any other liquid) that is air-tight. This prevents combustion and naturally prevents fire.

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Oil storage systems	Underground tanks
Oil burning systems	Storage and control
Oil filtration systems	systems for liquids.

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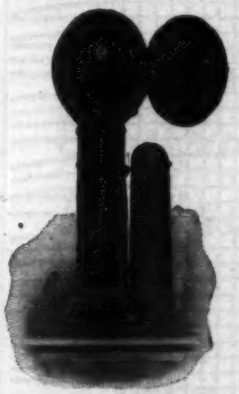
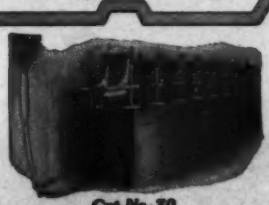


Cut No. 11
For air and water at the curb

Cut No. 35
First floor lubricating oil outfit



Cut No. 70
First floor paint and outfit

Cut No. 223
Portable wheel tank for both gasoline and oil

Write for Bulletins 35 PI, 11 PI, 70 PI, 223 PI today

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Oil Storage Systems

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¶ Make any test you wish.
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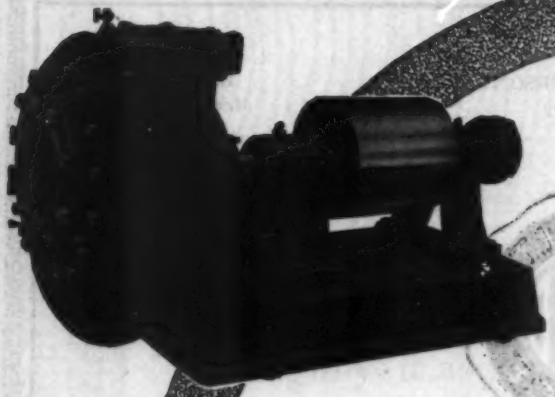

"Buffalo" Paper Pump

Designed and Built to Eliminate Clogging

Buffalo Paper Makers' Pumps are designed to meet the requirements of the paper manufacturer—for handling ground wood stock.

They are in successful use in the largest paper mills in the country for handling ground wood pulp.

Handles wood stock up to 4%

¶ Built for heavy duty continuous service—non-clogging—special designed impeller with extra wide openings.

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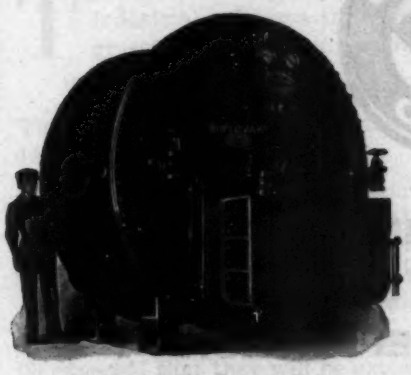
Buffalo Steam Pump Co.
Buffalo, New York

"Buffalo"

"BUFLOVAK" EVAPORATORS

Recovery of Sulphite Waste Liquor



"Buflovak" Horizontal Tube Evaporator.

THE recovery of sulphite waste liquor from paper mills is one of the important fields developed through the "Buflovak" Vacuum Drum Dryer, which converts the liquor into a dry powder at a very low cost, thereby yielding a handsome profit. We will gladly send you details regarding the necessary equipment.

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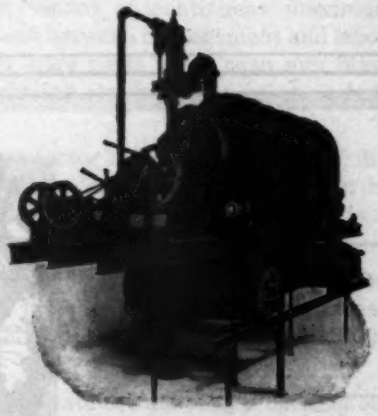
high quality of products, long life and low maintenance costs have secured the adoption, by leading manufacturers, of

"BUFLOVAK" AND "BUFLOKAST" PRODUCTS

"Buflovak" Vacuum Dryers } For all materials
"Buflovak" Evaporators } and capacities.
Leaching Cells, Causticizers, Digesters, Vacuum Pumps, Condensers, etc.,
"Buflokast" Chemical Apparatus.



"Buflovak" Vacuum Drum Dryer.

Catalog mailed on request

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Kalamazoo Mich.

EDITORIAL

THERE is no better definition of the tremendously important subject of industrial relations than the slogan used by one of the leading and progressive companies in our own industry:

"OUR PEOPLE DO NOT WORK FOR US, THEY WORK WITH US."

This sentence expresses in the fewest words possible, the whole secret of Correct Industrial Relations.

There is a vast amount of pessimistic literature being disseminated through the medium of the public press, that purports to be on the subject of industrial relations, and which seemingly proves the fallacy of modern relations between management and labor, but upon analysis it will be found that the subject is the very antithesis of industrial relations, Industrial War.

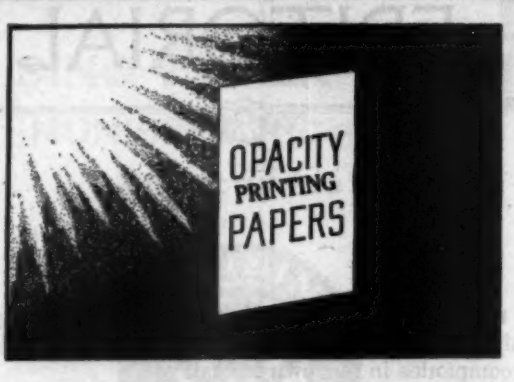
Strikes and lockouts mean war, and war is news, big news, therefore, it should be expected that they will be exploited as big news, while correct industrial relations mean industrial peace, an unbroken record of continuous maximum production without any strife or disagreement between management and labor. This is humdrum every day life, that has no more news value than any other essential of our social system that is performing its functions in an orderly manner.

When you wish to make a study of the human factor in your own business, disregard the appeals to passion of the public press, as they are based upon instances of disagreement. They give but one side of the controversy, and this is so obscured by passion that it is unworthy of your consideration.

Sensible industrial relations bring about the true brotherhood of employer and employe, and pay incalculable dividends in increased production as the natural sequence of the health, happiness, contentment and prosperity of the workers.

Action is not the whole of life. We need to cultivate the art of approaching our problems with reason, and not with the passion typified by the advocates of direct action. We need to stand a little apart, with reason as our companion and make a thorough analysis of the concerns in our own industry. The mills that have a satisfied personnel and no labor troubles are setting the pace for the paper industry in the application of Correct Industrial Relations to their business. These are the steady plodders that continue to produce the goods irrespective of so-called general conditions, and whose attitude towards their employes is summarized in that one significant sentence:

"OUR PEOPLE DO NOT WORK FOR US, THEY WORK WITH US."



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PAPER COMPANY

Kalamazoo, U. S. A.

World's Largest Manufacturers of

Opacity Book and Catalog Papers

PLANTS OF THE BRYANT PAPER CO., KALAMAZOO, MICH.

A Happy New Year

FOR the past few weeks in meeting any of our friends, or even casual acquaintances, it has been the custom for them, and for us to say "A Happy New Year," or "We wish you a Happy New Year," or "We hope you will have a Happy New Year," but we never hear anyone tell someone else how to have a Happy New Year. Each one is wishing the other will have a Happy New Year, or rather saying it, for it has become merely a stereotyped expression with many of us, but no one seems to know the best way, or to give any real advice how to accomplish this result.

There are many things that can be done to make 1920 a real Happy New Year. First, if we have made our resolution, or even now make one, "to do unto others as we would that others do unto us" and live up to it, this would not only cause a Happy New Year for most of us, but would nearly bring in the millennium. If we would resolve not to say an unkind word to or about our neighbor, and our neighbor means every other man, heaven would not be very far away.

If we would resolve this year to produce more and consume less, it would help to make a Happy New Year not only for this Nation, but for all of the others that are so dependent upon us. If the employe would resolve to do his best for the employer, this would make a happier condition for both of them, and likewise for the employer to treat the employe with due consideration, would help considerably.

Of course, to resolve to do things, and then not do them, as has been the case in most of the years gone by, does not help to make us any better or happier, but if we will go about this honestly, and live up to our resolutions, 1920 will be the banner year for happiness for us all.

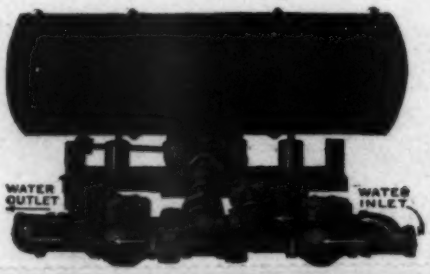
EDWARD B. FRITZ.

Canadian Mills Add To Coal Saving Records of Farnsworth Systems

(This shows one of the big paper mills in Canada saving coal and increasing production by the use of the Farnsworth Forced Steam Circulation system. This modern mill is not only making good use of water power but has taken advantage of the latest development in the paper industry—the elimination of individual traps on dryers, increased production by better drying, a constant, even known condition at all times and feed water at a high temperature.)

THE FARNSWORTH COMPANY, Conshohocken, Pa., solicits your inquiries. Large paper mills contribute to the coal-saving effected by Farnsworth Systems in this country and abroad. Here in the United States Farnsworth systems are saving 1000 tons of coal per day in textile mills, soap factories, oil refineries, laundries, etc. This is a conservative estimate taken from records of mills "Farnsworth Equipped." Our systems have saved and are now saving more than 10% of the coal in 550 plants. This is a GUARANTEED coal saving. In the majority of our installations our system has paid for itself in less than the first year it has been in operation in coal-saving alone, not to mention time, material and labor saved by use of our machines. Let us solve your heating problems.

If the Farnsworth Company had contracted to equip plants in the last two years under a guarantee on coal consumption with the understanding that after these systems paid for themselves we were to get the profits of the coal saved in one year, we would receive a net income of $5,000 per day. These dividends are now being paid to the owners of plants "Farnsworth Equipped." This company takes pride in the record made and the continuous coal-saving effected by the consistent operation of our system at a time when the country is facing such serious coal problems and when the cost of fuel is increasing.



To Solve The Above See Other Side

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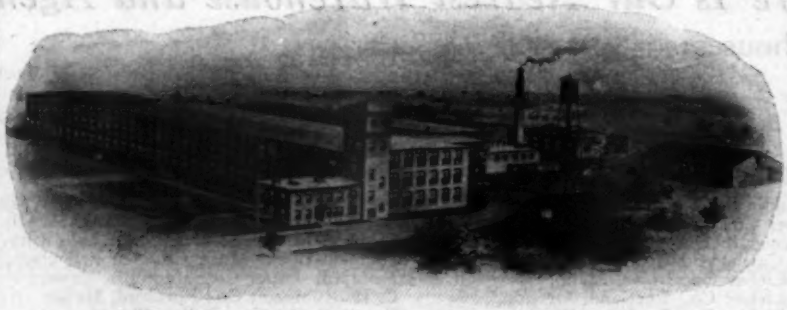
ALBANY FELTS are adapted for every type of Paper and Pulp Machine, and for every kind of stock. Every one is made of Pure Wool of the very best quality.

¶ Twenty-five years' experience in making Paper Makers Felts and Jackets has shown us how to make them as best suited to the needs of various kinds of machines and stock.

¶ Every possible effort is made to give our customers the best satisfaction and to weave into our Felts and Jackets the longest possible life.



ALBANY FELT CO.
ALBANY — NEW YORK

US

HOSE

RAINBOW Machine Hose

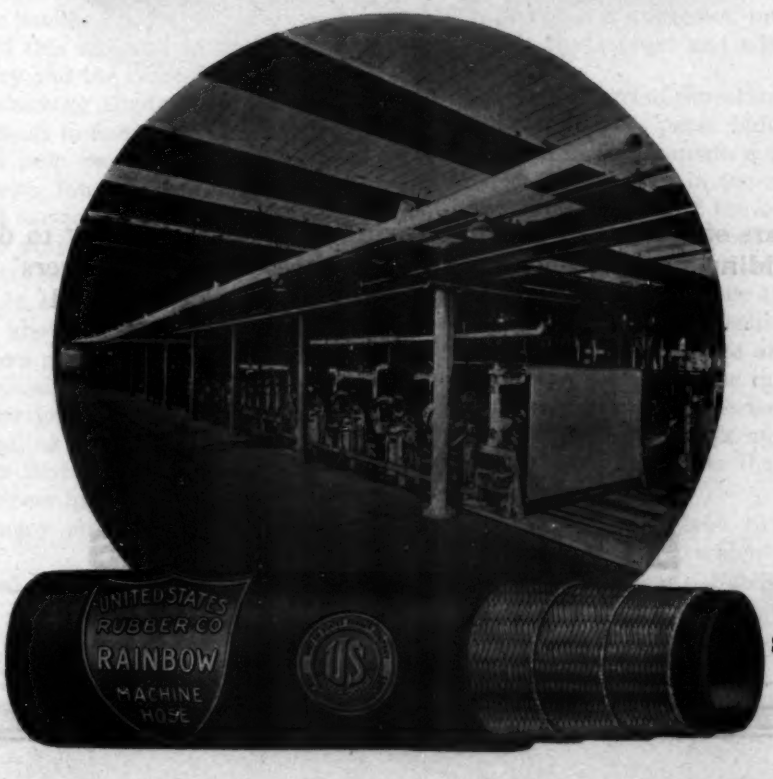
Rainbow Machine Hose is constructed to withstand the hard usage which hose receives in washing up around paper machines.

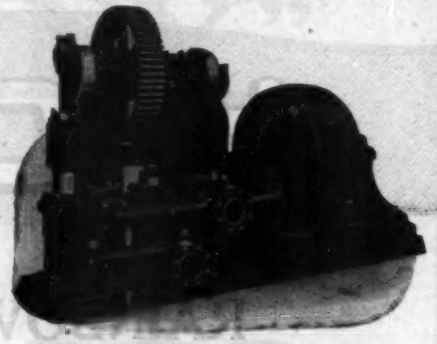
It is strong, yet sufficiently flexible to take sharp bends without kinking. Its cover protects it against the abrasion resulting from being dragged over rough wooden and concrete floors.

The long service built into Rainbow Machine Hose makes it the most economical on the market.

"The Right Hose in the Right Place"

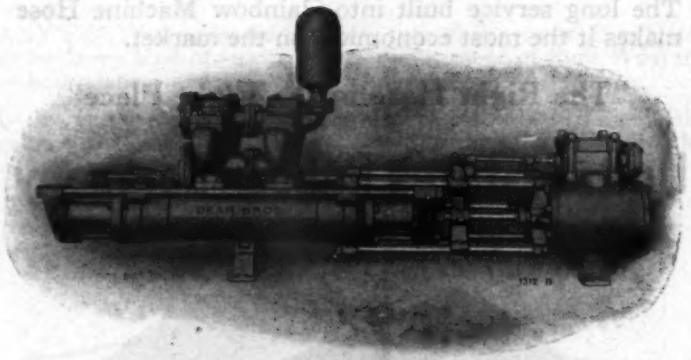
United States Rubber Company





Vertical Triplex Electric Pump

PUMPS FOR ALL PURPOSES



Horizontal "Durable" Duplex Steam Pump

Fifty years of successful manufacturing, devoted exclusively to designing and building pumps, enable the purchaser of Dean Brothers' product to buy the correct pump for the service required

SEND FOR CATALOGUE 127

DEAN BROS.
STEAM PUMP WORKS
INDIANAPOLIS

The Greatest Need of the Paper Industry

AN EDITORIAL BY GEO. W. SISSON, JR.,
President of the American Paper & Pulp Association.

TO ATTEMPT to state the greatest need of the paper industry would require careful balancing of the many pressing needs which all thoughtful men in the industry recognize as essential to its success. The paper industry as it now exists, particularly as reflected in the manufacture of wood pulp papers, presents many features of a young industry, taken up originally in the crudest fashion, carried on for many years without material change in processes and with comparatively very little scientific research given to its problems.

If one attempted to criticize, which is not always best, he might say that the manufacturers of wood pulp papers had been conducting their business in the past largely by "rule of thumb," confining their attention too closely to the turning out of tonnage and being only slightly interested in scientific determination of ways and means to improve quality and eliminate wastes.

While the industry has made gigantic strides in the past generation and today assumes the mighty proportions of the sixth or seventh basic industry in the country, it already finds itself looking, and without much promise, for its further supply of raw material. Its prodigal and wasteful methods, both in the forests in the handling of the pulp wood and in the manipulation of this material in the mill, have brought the industry and the consuming public face to face with an alarming condition, remedies for which it will be difficult to find. The executives and managers of wood pulp paper-making enterprises have generally grown into the business naturally from lumbering and saw mill operations. They were strong men, able to grapple with the wilderness, to harness water powers and to put them to the crude work of grinding pulp, a process apparently requiring no great scientific knowledge or research. Consequently the managers and owners were rather slow to recognize the necessity and desirability from the standpoint of production, quality and economy, of really scientific handling of their business, and it is only in recent years that the chemist, the physicist and the trained engineer have been called in to bring exactness and economy into the operations of the industry.

With this original state of mind on the part of owners and managers and with very little precedent or body of knowledge available to those who might choose paper making as their craft, it is not surprising that the workers in the industry as a rule had very little special training to fit them as all round paper makers. In certain plants systems of training have been established and, where the management and the superintending officials have the faculty of imparting their knowledge to the workmen and where a spirit of enthusiasm and interest in the product is created, marked results have been shown. In perhaps no other industry of equal magnitude has the education and training of its workers been so neglected. Systems of apprenticeship training and methods of special instruction for the upgrading of workers have in other industries developed a body of workmen who knew the manufacture of their goods in its theory and practice from bottom to top. Such workmen are scarce in the paper industry and it is not the fault of the men themselves. It is my belief that the one crying need of the paper industry today is some systematic, well organized plan for the training and education of paper makers, and it is my hope that out of the deliberations of the Committee on Education of the American Paper & Pulp Association there may result a suggested program so practical as to enlist the support and adoption of it by the industry.

While it is all a part of education in the broad sense, one great need of the paper industry in the manufacturing end is to stimulate a greater respect for the product by the men in the mills, and a higher appreciation on the part of the ownership and management of the dignified position their industry commands among the industries of America.

This sense of the importance and necessity of our industry, together with the feeling that we are supplying a great public need and are contributing one of the important factors in the spread of civilization, should inspire every one connected with the industry to put it on the most scientific and efficient basis for service to the country and to the world.

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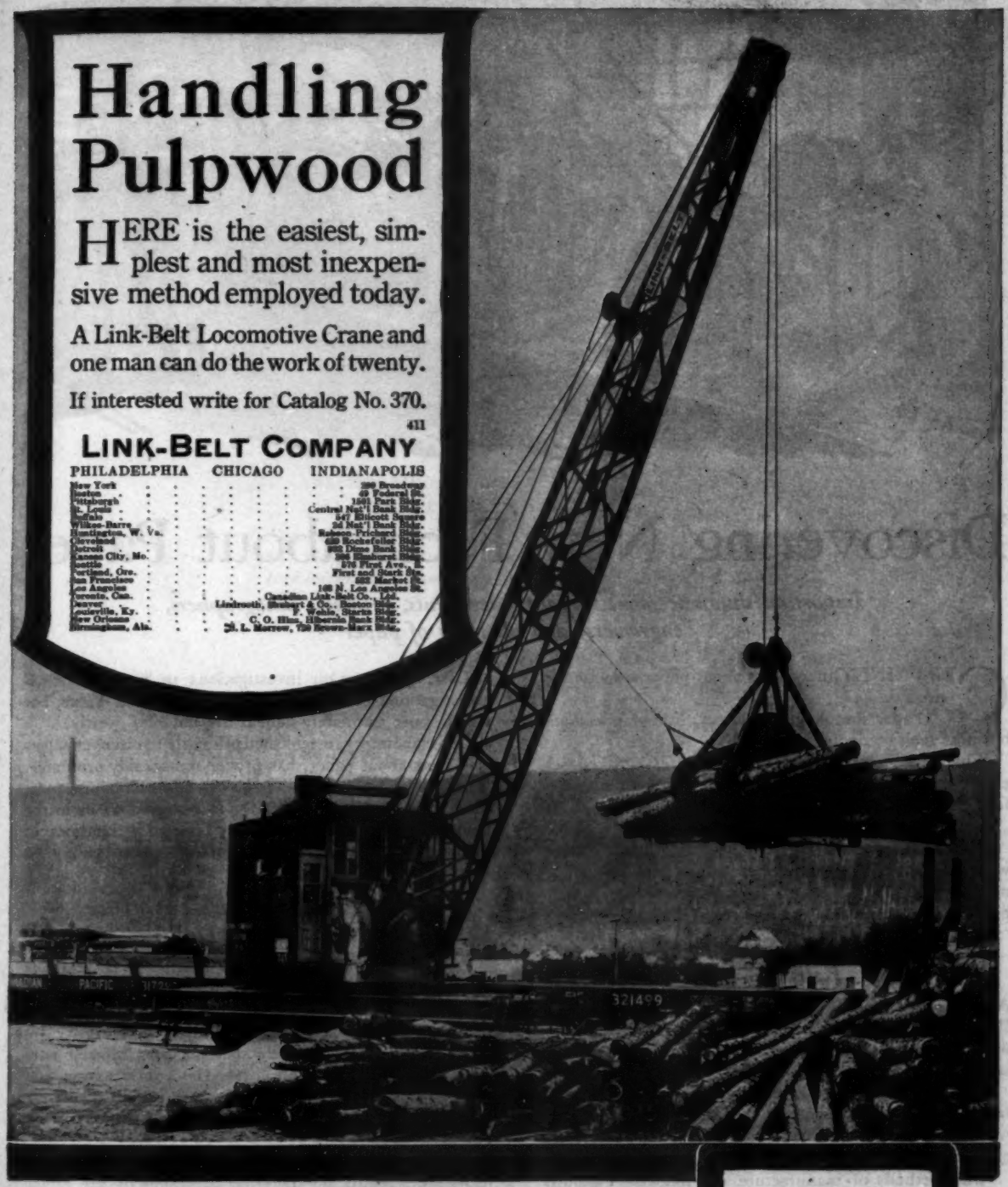

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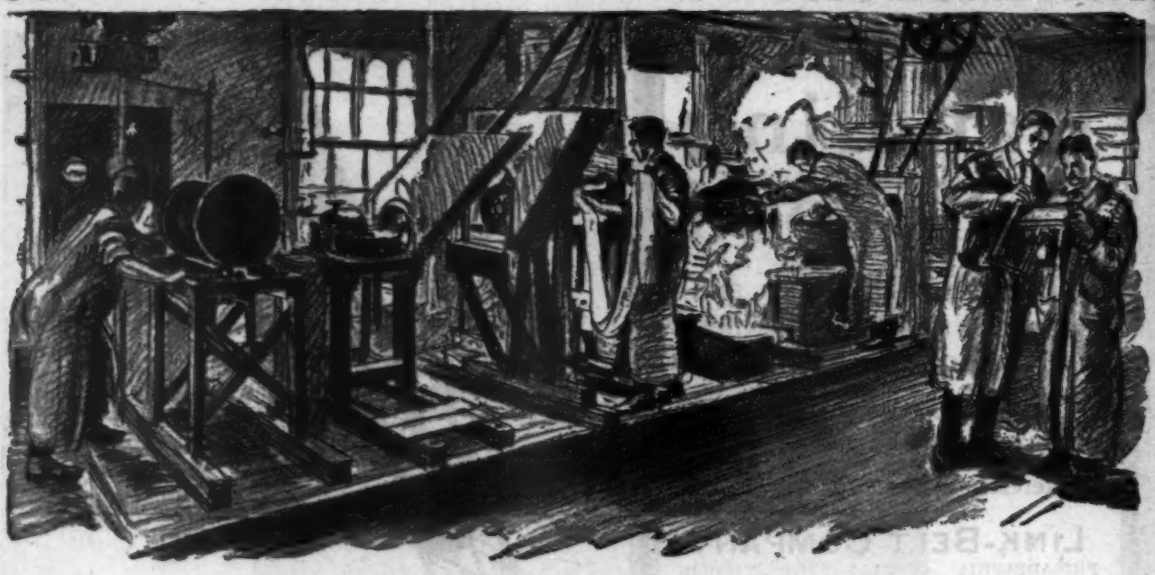

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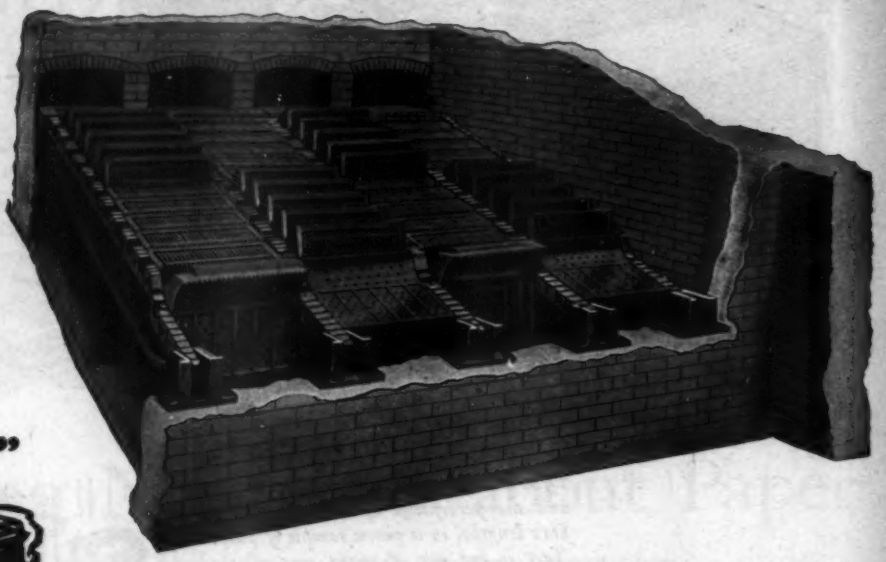

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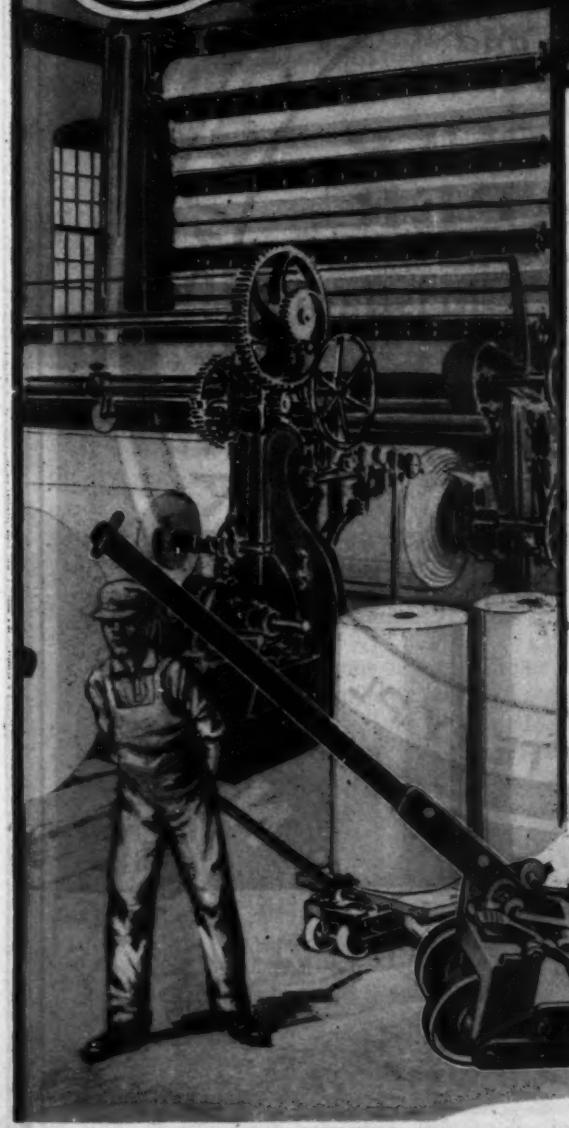

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HE publisher of The Paper Industry hoped, when this journal was started, that there would be no necessity for increasing the advertising rates. These rates were put at the lowest possible point consistent with getting out such a journal which has many heavy costs to it not connected with weekly papers. However, we could not then foresee what the printers would have in mind a little later. Everyone knows the recent troubles in the printing plants in New York, and while the same troubles have not been experienced in Chicago, yet prices have steadily advanced, which, we believe, is to a greater degree than in New York. We have had two large advances recently, and we feel in order to furnish a high-grade publication it is necessary to raise the rates. This advance will be only a small one, and only pays a small part of the advance to us. However, we shall be more lenient than is done in most cases, and want to advise that this advance will not take effect until February 1, and even then not for our present advertisers, nor for those who sign contracts for running space before February 1. For the latter the old rate will be continued all of 1920, and on January 1, 1921, all advertisers will then be put on the same basis, as we do not believe in the plan of so many other papers, that is, giving one firm one rate and another firm another rate, for we want to give our best to every firm.

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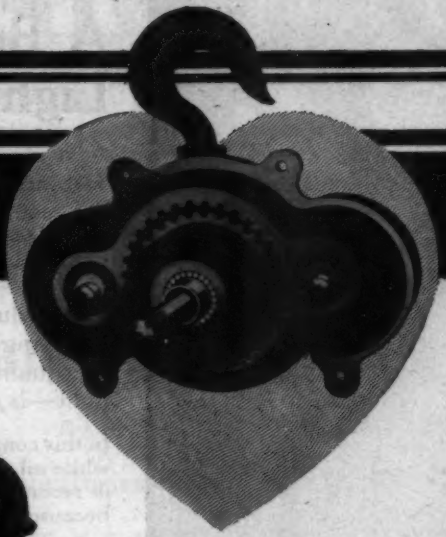

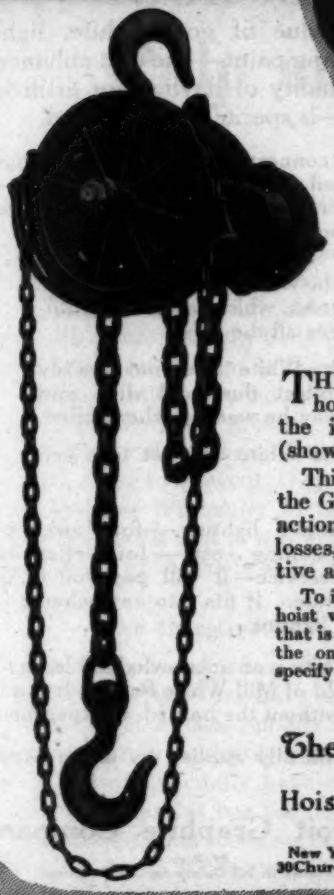

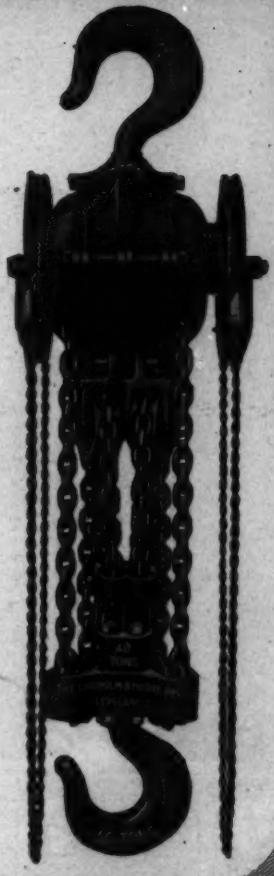

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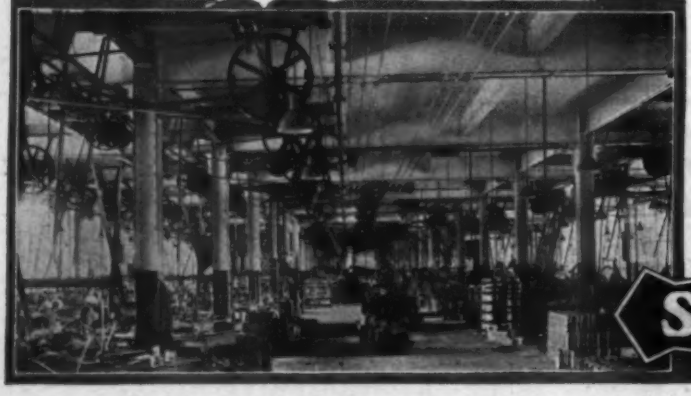

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STA-WHITE MAKES THE DIFFERENCE

THE PAPER INDUSTRY

"The Educational Magazine for the Paper Industry"

Vol. I January No. 10

Prevention of Decay in the Timber of Pulp and Paper Mill Roofs

By R. J. BLAIR, Pathologist

Forest Products Laboratories of Canada, McGill University, Montreal

THE decay of structural timber is a subject which has received considerable attention at the Forest Products Laboratories of Canada. This trouble is often found in buildings where a lot of moisture is always present in the air. In a large number of textile mills, dye houses and canneries, where such conditions are present, the factors responsible for timber decay have been studied to find what may be done to prevent these losses. Such losses take place so frequently in the roof timber of pulp and paper mills that it was proposed to make a systematic study of the roofs of all of the Canadian mills.

The Investigation

At the present time more than eighty of the mills listed in Lockwood's Directory have been visited and the conditions found in these plants show that the proposal for such an investigation was entirely justified. Nearly all of the mills have used wood for building their roofs, and it has been found that only a very small minority has been successful in avoiding trouble with decay in their roof timber. In one of the newsprint mills the roof of a machine room made of 3" planks has been renewed this year after a service of only five years. This is the most extreme case found, but it shows what might be expected to happen in any mill where no precautions have been taken to avoid this sort of trouble.

In the eighty mills visited it was found that twelve renewed some part of their roofs recently, seventeen are making renewals this year and twenty-four others will be doing the same thing within a short time. Of the roofs, which have been coming off this year, the service has been from five to nineteen years with an average of about eight or ten years. The result is that the paper industry is constantly experiencing heavy losses since the cost for upkeep of the mills has to be increased to a figure much beyond that which should be necessary. EVERY BIT OF THIS TROUBLE IS PREVENTABLE IF SPECIAL PRECAUTIONS ARE TAKEN IN BUILDING THE ROOF AND IN CARING FOR IT AFTERWARDS. It is the purpose of this paper to discuss the various conditions which favor the decay of timber in mill roofs, and to suggest what may be done to avoid the losses resulting from this source.

Types of Roof Commonly Used

Little depends upon the kind of wood which has been used for roofs, as bad ones were found made of southern pine, white pine, red pine, spruce, Douglas fir and tamarack. Numerous ways for constructing roofs are in use, but all are more or less unsatisfactory on account of decay which develops in the timber. The following types of roof were found in bad condition: 1" board, 2", 3" or 5" planks, 2"x 3" or 2"x5" planks on edge, single planks, planks sheathed without an airspace and planks sheathed in such a way as to form an airspace of 1, 4 or more inches. Whether made of straight-edged boards, tongued-and-grooved lumber, or planks joined together with splines, no material difference in the lasting quality of the roof has been noted. All are

Fig. Four—Fruiting bodies of (A) Lentodium, (B) Lenzites, (C) Poria, three varieties of fungi very destructive to Paper Mill Roofs

equally bad. The bad feature which is common to each of them is that moisture enters the spaces between the planks and reaches the upper side of the roof where it causes trouble.

Defects Found in Mill Roofs

Most roofs which give trouble with decay are also unsatisfactory on account of moisture condensation on the under surface during cold weather. If we are to design a roof to give good satisfaction these two points must be kept in mind and both bad conditions must be avoided. As a rule, the roof which is troubled with moisture condensation is being attacked by decay and a roof which has started to decay gives trouble with condensation.

It has been found that each one of four different conditions has a more or less important bearing on

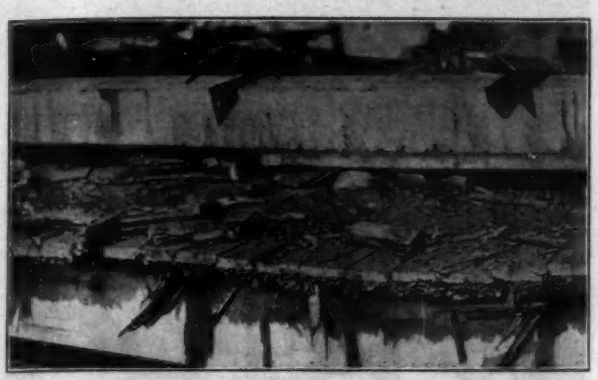


Fig. One—Roof Planks after seven years' service on the Machine Room of a Canadian Mill

the lasting quality and service given by a mill roof. These conditions are:

1. Natural ability of the wood used to resist decay.
2. Heating of the mill so that the roof does not get too cold in cold weather.
3. Insulation of the roof against loss of heat through it.
4. Removal of moisture from the mill by ventilation.

The Cause of Decay

What is meant when any piece of wood is decayed is that a low form of plant life, called a wood-destroying fungus has been at work within it. In common with all forms of plant life, the fungus has certain moisture requirements which must be satisfied before it can begin to grow. As long as wood remains dry a fungus can do it no harm, but as soon as the amount of moisture required by the fungus is present in the wood, it is certain that decay will be set up. The point then, which it is of the greatest importance to keep in mind in designing the roof of a mill, is to build it in such a way that at all times the timber is too dry for the fungus plant to get an opportunity to grow within it.

The active part of the fungus plant consists of a great number of very fine branching hairlike filaments which penetrate the wood in all directions. The filaments are called hyphae, and as they pass through the wood they dissolve out part of its substance so that it rapidly deteriorates.

Under certain favorable conditions fruiting-bodies of fungi, commonly known as toad-stools or mushrooms, are produced on the surface of the wood and

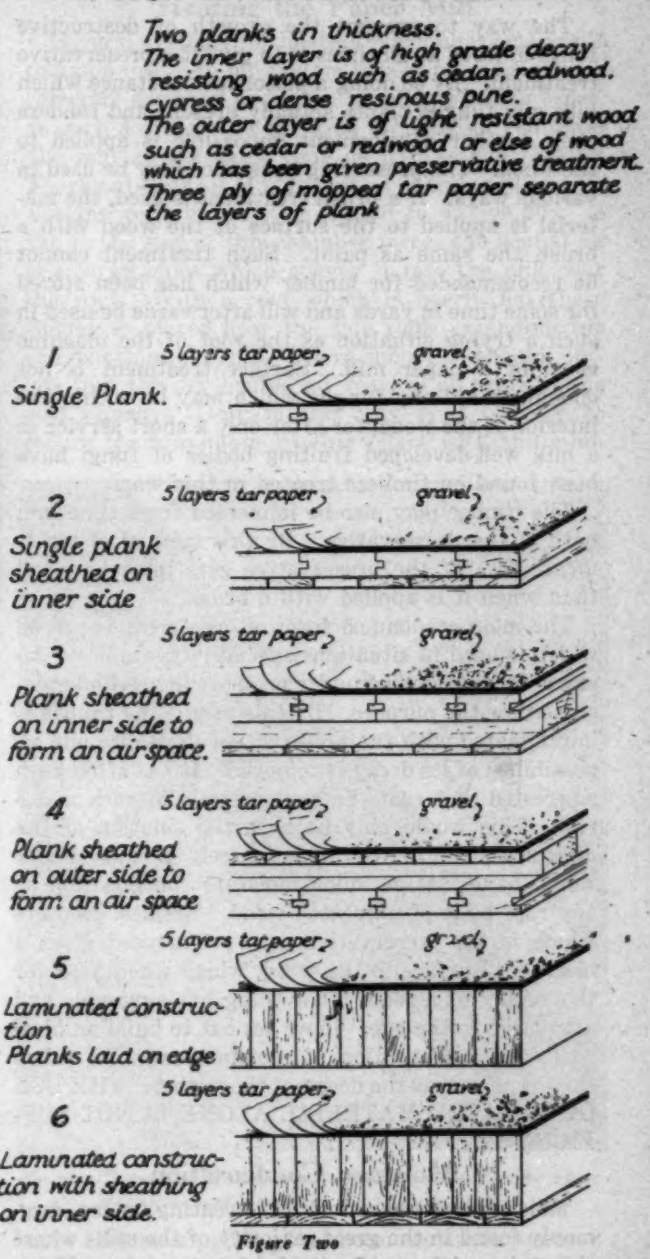

Two planks in thickness.
The inner layer is of high grade decay resisting wood such as cedar, redwood, cypress or dense resinous pine.
The outer layer is of light resistant wood such as cedar or redwood or else of wood which has been given preservative treatment.
Three ply of mopped tar paper separate the layers of plank
1
Single Plank.
5 layers tar paper
gravel
2
Single plank sheathed on inner side
3
Plank sheathed on inner side to form an air space.
4
Plank sheathed on outer side to form an air space
5
Laminated construction
Planks laid on edge
6
Laminated construction with sheathing on inner side.

Figure Two

Each of these types of roof is bad because moist air easily reaches the cold upper side where moisture condensation occurs.

from their appearance the species of the fungus is determined. One form which is particularly destructive much resembles the common edible mushroom;

another one which is very often found consists of a brownish disc or shelf furrowed on its under surface; while a third variety covered with very fine bores spreads over the surface of the wood in a smooth sheet of a sulphur yellow color.

The Use of Preserved Wood

The way to prevent the growth of destructive fungi in wood at all times is to give it a preservative treatment. By so doing a poisonous substance which kills any fungus plants actually present and renders their further development impossible is applied to the wood. The preserving substance may be used in various ways. If a brush treatment is used, the material is applied to the surface of the wood with a brush the same as paint. Such treatment cannot be recommended for lumber which has been stored for some time in yards and will afterwards be used in such a trying situation as the roof of the machine room of a paper mill. Surface treatment is not enough to kill any fungus which may be within the interior of the wood, for after only a short service in a mill well-developed fruiting bodies of fungi have been found on timbers treated in this way.

The timber may also be immersed for a time in a bath of the preservative. By this method of treatment more of the preservative gets into the wood than when it is applied with a brush.

The most economical form of treatment for wood which is used in situations specially favorable to decay is the one applied under pressure in a cylinder designed for the purpose. By this means the timber is impregnated with the preservative substance and all possibility of its decay is removed. It has often been suggested that roofs be built entirely of such material. This would only be a partial solution of the difficulty since a roof made entirely of this timber would have just as much moisture condensation as any roof built of untreated wood. Besides, creosote which is the preservative most often used gives a black oily surface to the wood, which when used for the ceiling of a room is anything but agreeable and attractive to the eye. If we set out to build an ideal roof, the condensation of moisture must be taken care of as well as the decay of the timber. THE USE OF TREATED MATERIAL ALONE IS NOT SUFFICIENT.

Moisture Condensation

Moisture condensation, or sweating as so commonly found in the great majority of the mills where the air is moist, may be divided into two parts. There is the condensation due to very imperfect ventilation, which forms at the under surface of the roof and collects in drops which soon fall causing damage to whatever is beneath. There is also the condensation due not entirely to insufficient ventilation, which takes place in the spaces between the planks of the roof and between the planks and the roofing paper. Later some of this moisture collects in drops which unites with those at the under surface of the roof.

The explanation of the moisture condensation is simple. The air in the great majority of paper mills is very moist. Some of the moisture in this air will be condensed into water as soon as the air has been cooled to a temperature below its dew-point. This air is so very moist that a drop in temperature of but a very few degrees is sufficient to bring about this change. Great volumes of moist air leave the paper machines at a high temperature. Being warmer than the surrounding air this heated air at once rises to the roof unless seized by some ventilating appliance which carries it out-of-doors. In cold weather the inner side of the roof is so much cooler than the air of the room that when the moist air

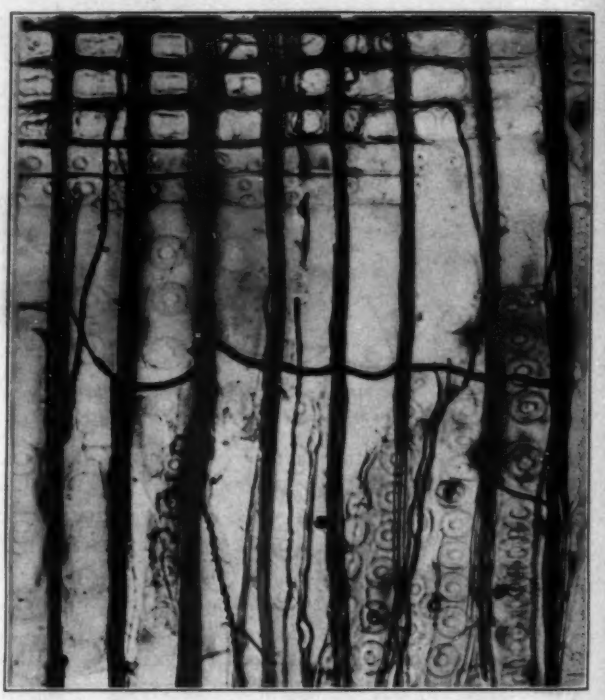


Fig. Three—Section of Decaying Wood containing Fungus Hyphae magnified 250 times

strikes it it is cooled below its dew-point. When this happens some of the moisture is deposited on the roof plank and after a short time it collects into drops ready to fall. This explains the first type of condensation. With the other kind, the mechanism is the same, but the action goes on in a more concealed manner. As in the previous instance the moist air rises to the roof, but some of it enters the spaces between the planks and makes its way to the cold upper side of the roof. Very often there are spaces between the planks and the roofing paper. In cold weather this space is always so much colder than the air of the room, that when moist air gets into it the moisture will certainly be condensed. The cooled air is heavier than when warm so that it finds a lower

level and a place is formed for the entry of more moist air. A permanent moist condition is thus maintained upon the upper side of the roof planks for several months at a time and a most favorable condition is created there for the development of a fungus plant.

The upper surface, or a region in the interior, begins to decay and as the rotting progresses it works down through the planks.

The decay is usually more pronounced where the planks are in contact with the spiking strips, or purlins, since at such points the roof is a little cooler than at other places and condensation takes place there more easily. At the most, only a few years are

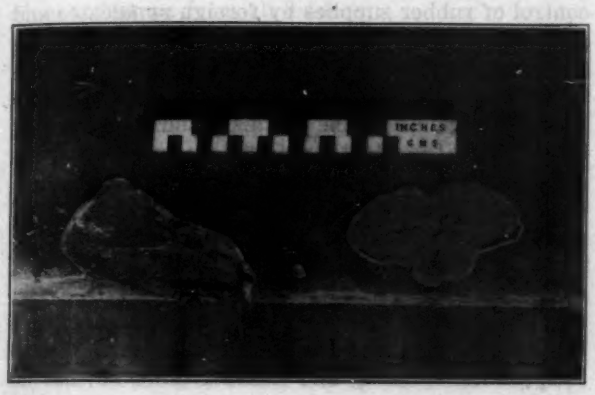


Fig. Five—Merulius Tremuloides on a brush treated Southern Pine Timber in a new Paper Mill

required for the wood to rot to such an extent that renewal becomes necessary.

The Roof Deck

Forming as it does the ceiling of the room, the first layer of wood used in the roof should be of dressed material, which may be painted. It is not necessary to use treated lumber for the deck of the roof. Later there will be discussed the value of an insulating layer placed on this roof deck for the purpose of heat insulation. This extra layer prevents moisture condensation with the result that the possibility of decay in the timber is very remote. To make reasonably sure, however, that the roof will be as safe as possible, this first layer should be of high grade material naturally resistant to decay. The best choice would lie with cedar, redwood, cypress or dense, resinous southern pine. This first layer should be no more than 2″ in thickness and the span should be such that a 2″ plank may be safely used.

Cedar or Redwood for Roofs

The best roof would be made entirely of wood light in weight and naturally resistant to decay. Either California redwood or cedar is eminently fitted for such a purpose. Both of these woods naturally resist the attack of fungus and for this reason alone are better for roofs than woods not having this property. They have the additional advantage that on account of their low specific gravity their heat conductivity is less than that of the woods which are usually used for structural purposes. A considerable saving in heating would result from the use of such timber in building a roof.

Heating the Paper Mill

Several systems for heating machine rooms are in common use. An air system is best provided if it is correctly designed and maintained in working order. In such a system the air used for heating ventilates the mill at the same time as it does the heating. Fresh out-door air is taken into a chamber filled with heating coils where it is heated to 65° or 70°. A fan in the side of this chamber forces the heated air into large pipes which convey it into the mill near the roof. With a roof which is nearly flat these should be placed near the side walls extending the full length of the mill. There should be enough outlets that the dry heated air reaches all parts of the roof equally. Only in this way is it possible to secure the maximum heating effect with the mini-

Fig. Six—Traces left by moisture which had condensed at the upper side of the roof planks and caused decay in them

mum of heat supplied. As the moist air is removed from under the hoods of machines the newly admitted air finds its way down, replacing that removed with the steam so that a constantly changing layer of dry air is found at the roof. This is a feature which tends to keep the roof dry and thus prevents both condensation and decay. In very wide machine rooms, or rooms with steeply pitched roofs it would

(*Continued on page* 852)

Service to Be Expected from Rubber Belting

By R. R. PEEBLES

Presented at the November meeting of the Michigan Division

MR. CHAIRMAN and Gentlemen—Michigan Division of the American Pulp and Mill Superintendents' Association:

Permit us to thank you for the honor and confidence you have placed in us in issuing an invitation to address you on the subject of "Service to Be Expected from Rubber Belting."

As manufacturers of these products we have gathered statistics and information which we feel will be of interest and value to you in assisting to secure the fullest possible results from your investments in power transmission.

We are not going to violate your confidence by using the opportunity to advocate the adoption of any particular brand or make of belting, but will give you the benefit of the experience of the manufacturer whose sole purpose it is to find and overcome the conditions which destroy belting, and to construct belting that will best resist these conditions.

You who are manufacturers of an assembled or fabricated product and large users of transmission belting, will readily understand the conditions which have confronted us in establishing records and a reputation for perfected goods.

We do not mean to imply that greater perfection is impossible either in your products or ours, but just so sure as the rivers no longer run red and yellow whenever your stuff chests are changing colors, the waste, carelessness and haphazard construction of transmission belting has been eliminated by modern methods.

We may rant at times at the controlling influence of the efficiency experts, but are forced to acknowledge the continually improving conditions, which hearty co-operation with all things economic are bringing about.

In turning back the pages of history to the days when canvas belts were first improved by rubber covers, we find a record of belt efficiency that is not a standard for today.

The continued improvement in both the basic materials and methods of manufacture are as marked as the comparison of speeds in a 48-inch paper machine in 1880 running the year round to produce the Hostetter almanac cover and the ten-foot machines today operating at five or six hundred feet a minute.

Belting history from inception to its present perfection covers a long period of hard work, research, and the invention of ingenious and complicated machinery.

There are many interesting stories in this connection which in themselves would furnish valuable topics for discussion: The methods of securing rubber from the original forests, its improvement to eliminate destroying the trees; the overcoming of the control of rubber supplies by foreign syndicates and governments; the transplanting of rubber to plantations established by the large rubber goods manufacturers, are all indicative of progress. There are also the achievements of the chemists and compounding laboratories, the adoption of modern curing methods and development of long-lived rubber compounds.

Probably the greatest factor in the development of rubber belting is the forward movement of the materials or duck manufacturers to produce a higher and more dependable standard of duck. This has been brought about by the progressive manufacturer who has himself gone into the raising of cotton and who is operating spinning and weaving mills, so that he can accurately determine just what processes and tests are necessary to assure him of securing a uniform standard of material and on the correct basis of cost.

The manufacturer of rubber belting who had the true conception of what the necessary foundation was for satisfactory and increasing sales of his product was confronted by many sales resistance conditions. Some were guilty of the very common error of blaming their factory management, superintendents or engineers for inability to produce maximum service at minimum or competitive costs, while the real weakness was in their purchasing and sales departments.

We are satisfied that you will agree with us, that backed by a Sales Department that knows the value of service and by a Purchasing Department that will provide you with the best of materials for the purpose intended, there will be no opportunity to censor the factory or mill management.

Fortunately, there are many large and successful industries where the forces of buying, manufacturing and selling are working in perfect harmony, and from such we are getting the best and most satisfactory products, whether they be supplies for our own manufactured products or materials used in the construction or operations of our plants.

There are others, by whom recommendations, based on records of service, are entirely ignored, and where the old impossible presentations of "as good or better goods at lower prices," and still accepted as gospel by the "penny saved and pound foolish."

We do not refer to the Purchasing Department which, co-operating with the factory management, keep down their costs by following every advantage in buying. We refer to the buyer some of whom are still left, who without comparison of service or quality ask first, what is the price.

Returning specifically to the question in hand, "The Service to be Expected from Rubber Belts." (There are purchasing departments that have honestly endeavored to do competitive buying of rubber belting by asking prices from the manufacturer based on a specification which would seem at first glance to have the possibilities of compelling an exact duplicate of products, and consequently comparative costs of manufacture from all bidders).

We will read to you a short and concise specification which some of you will undoubtedly recognize and on which we understand the purchaser reports that a perfectly satisfactory and serviceable rubber belt has been secured for a number of years.

Quotations to be given on the following: 36-ounce duck, heavy strand or warp to run lengthwise of the belt and not crosswise. Friction to be not less than 23 pounds. One sixteenth cover on the face of the belt of the very best compound possible for this purpose, canvas to be carefully selected and firmly woven. Stretch to be reasonable but not entirely taken out.

Taken at its face value, this specification will permit quotations on almost any 36 ounce 23 pounds friction surface belt made, because it does not, and we believe could not go sufficiently into detail to secure identical construction from various manufacturers.

The secret of always having secured satisfactory belts made on this formula has undoubtedly come from good judgment used in selecting a known source of supply where the intention of the specification was considered rather than the variety of quotations which must have resulted from different conceptions of what are "best compounds," what constitutes "carefully selected canvas" or "reasonable stretch."

We have here an elaborate specification issued in June, 1918, by one of the most important coal and ore mining and transportation companies. It consists of specifications for three grades of rubber transmission belting and one for coal conveying.

The specifications were evidently written to cover as far as possible every detail to compel competitive bidding and uniform construction.

We will present one of these specifications with comments to show that although apparently complete, it leaves the quality and construction of what might be a good or a poor rubber belt entirely to the bidder and his conception of what is good, better or best.

"Friction surface belt for heavy duty, 18 to 20 pounds friction, 32-ounce duck, 42 inches wide.

"The duck used in the construction of this belt must be of the best grade of long staple cotton, and must weigh 32 ounces to the linear yard, when 42 inches wide.

"The tensile strength of the duck must be at least 300 pounds per inch in the warp threads and 225 pounds per inch in the filling, and must show this after being treated and vulcanized.

"The test to be made on Riehle machines as follows: Use piece 2 inches wide 6 inches long—distance between jaws when test is started to be 2 inches. Jaws on machines to be one-inch front and two inches back, both top and bottom. The average results for three tests to be used.

"The rubber friction compound must be so generously applied to the duck and impregnated into it as to show a heavy coating of rubber between each ply, and when separated must show life and elasticity.

"A section 1-inch wide will be used in determining the friction of suspending an 18-pound weight to the separated end, the force being applied at 180 degrees. The rate of separation must not exceed 1-inch per minute.

"This belt shall not have a distinct rubber cover but shall be made with a friction surface; that is, the outside ply of duck shall be skimmed so as to leave the duck impression, otherwise known as a friction surface belt.

"All belts must be uniform and straight and free from surface defects of any kind.

"Belts that do not comply with these specifications will be rejected and returned to the manufacturers, who will be expected to pay all charges."

So great is the variation of kinds and qualities of duck and of the compound that can be used in these specifications that they permit of quotations on both low and high-grade material and deceive the buyer who can only make comparison of price. The varieties of cotton used in rubber goods include the American, Arizona, Peruvian, Osprey and other imported cotton of various strengths and lengths of fibre.

Some of the longest and finest of fibres do not produce the best of belt ducks, and different results are obtained from the same cottons when made of carded or combed stocks.

As a matter of fact, American standard belt duck purchased in the open market, and not subjected to the rigid tests demanded by manufacturers of high-grade belts, would not only meet the special specifications but would average a 60 per cent better showing in the warp and a 20 per cent better condition in the filler.

It is not our intention by mass of figures or confusing statements to discourage the idea that there is a way of arriving at a comparative value of belting. There are many ways and ways that would be simplified if materials and methods of manufacture were nearer the point of standardization which is rapidly coming, and if the buyer can have perfect confidence in the producer.

At present there are so many accepted and so-called

standard ways of testing fabrics in their per inch of width strength, and such a variety of results obtained by these different methods, that comparisons are impossible without specifying in detail the method used in testing.

Quoting from the reports of one of the best experimental engineers:

"There are a number of recognized methods in use for testing the tensile strength of fabric and finished belts. The same piece of material by these different methods may show a tensile strength of from 300 to 700 pounds per inch of width, when the same duck is built into a belt and the belt tested, entirely different results may be obtained."

To select duck of best strength and construction, we have adopted a method which does not give the maximum strength of duck, but one which is fair to both the duck manufacturer and belt consumer. Six samples from each roll of duck are tested and all rolls failing to meet the average test are rejected. Reading again from the engineer's report:

"The specimens are cut 2¾ inches by 6 inches long and placed in a Scott Fabric Testing Machine, equipped with a pair of 2-inch jaws at one end of sample and with a 1-inch jaw bearing on a 2-inch jaw at the other end. The two pairs of jaws are 3 inches apart at the start of the test, and are separated at a rate of 20 inches per minute. The machine registers the maximum strength of one inch of the duck at the moment the break occurs. These figures are then corrected for moisture. Cotton before being frictioned absorbs moisture, the Bureau of Standards has found that the tensile of cotton fabrics increases 7 per cent with each increase of 1 per cent of moisture content."

The engineer's report goes on to explain the several methods of testing used by various manufacturers of rubber belting, and shows clearly that after all, specifications cannot be written that will bring the desired results unless they cover in detail every possible condition from the name and grade of fibre, all the details of carding, combing, spinning and weaving, following this must come the details of all methods of testing and their results—if this were accomplished by a belt specification it would then be necessary to go into the details of the kind, quality and strength of the compounds used in the friction and in which the item of strength per inch usually very particularly specified can be met by the honest belting manufacturer with a long lasting compound or by another with one of low cost value meeting the initial test and becoming useless in a too short time.

We have gone into the details of materials that may be used in the manufacture of rubber belting and have shown that while figures obtain in testing do not lie, they may cause illusions and deceptions even when based on standard methods of testing, not fully covered by specifications.

Many of us are familiar with a booklet lately issued, which shows conclusively how very different conclusions can be drawn by manufacturers of the different products. For instance it gave credit to Balata Belting of 47 per cent efficiency and to friction surface rubber belting of 25 per cent efficiency as compared to leather. Naturally these records excited the entire rubber belt sales forces and demanded an investigation to prove the correctness of the statement.

One of the largest manufacturers of rubber belting and one who had discontinued the manufacture of Balata, because the rubber product had proven more efficient, conducted similar tests and found that the figures given by the report could be verified, by comparing the best grades of leather as against inferior grades of rubber, and because the booklet did not go into detail showing the complete methods of test, or kinds or brands of belt used, there was no reason or necessity to dispute their claims, and the rubber belt manufacturer whose proposition of sales are rapidly increasing can afford to be liberal, they will even admit the superiority of leather to run in oils or greases which are detrimental to rubber. There are, however, few places where belts need to come in contact with oil, and no conditions which could not be arranged to accommodate rubber belting to its best advantage and none that should not be so arranged for the sake of ultimate saving in belt costs.

The conscientious manufacturer knows that in selecting by comparitive tests the proper grade of ducks and by combining them with the best of friction, he is in a perfect position to furnish the maximum amount of combined power units to meet a given condition. He knows too that misapplication of any kind or quality of belting will result in unwarranted condemnation and increased cost of manufacture.

For instance, we have in mind two belts of high grade, one of 28-ounce duck and one of 36-ounce. An order for a 12-inch 6 ply belt might secure either, and while both would be economic on 18-inch pulleys, the larger and strongest of the two would be unsatisfactory on pulleys of smaller size or high speed.

The service to be expected from belting is in direct ratio with the quality and manner of application. Rubber belts in that they can be made up in slightly varying thicknesses, and are of a pliable and tractile nature are rapidly increasing in the field of power transmission, not only in mills demanding a moisture proof belt, but in the shops and factories where until the appearance of fraction surface belts, rubber belts were never known.

There are two important problems to be solved in transmitting power by Belting to the best advantage. The first one belongs to the manufacturer and has reference to his policy of merchandising. He can manufacture belting on a competitive price basis believing that a customr is born every minute, or he can build more certainly and more successfully on the true business of "What is best for the consumer is best for the manufacturer."

You as users or consumers desiring economy have

a problem which confronts both the manufacturer and consumer, the one that is of vital interest to both, and which both must acknowledge themselves responsible, is the question of under what conditions can the best belt service be secured.

In considering these problems the rubber goods manufacturers made investigations that were enlightening. They found that under proper conditions rubber belts could be manufactured and used successfully under a very large percentage of circumstances —that no complaints or dissatisfaction eminated from places where belts were properly applied—that where any adjustment or replacement has been asked, the trouble could be traced directly to errors, selection and application.

They found also that misapplication did not often result from mistakes in engineering or machinery design but rather from necessary or unnecessary changes and additions to original places or equipments without due regard to transmission conditions.

Many misapplied belts have been sold directly and indirectly by salesmen, by jobbers and by dealers without regard to when or how they were to be used. The practice was almost universal, was an injustice alike to the manufacturer, the product and to the user.

The manufacturer realized that the responsibility for these conditions was largely his own, that by the proper education of his salesmen and co-operation of the user, the correct installation would demonstrate that there was an economic rubber belt for nearly every condition, and if there were wrong conditions, there was no belt that would be satisfactory.

The manufacturer immediately inaugurated an educational campaign for the benefit of his salesmen.

Schools were established for them where all possible conditions of power application and transmission and material conveying were discussed and where the remedies for unsatisfactory service were actually taught.

The days of the hale fellow were met—the days of the "drummer" and the days of discount goods to meet the price have passed.

That service can be expected of rubber belting has long been known, but the extent of that service and the satisfaction that can be secured by right principles in manufacture, investigation of conditions and prescribing the right application of belting is only beginning to be appreciated.

Having done everything possible in the way of perfecting our products, from the seed in the plantations to the finished materials, the manufacturer now accepts the responsibility of recommending the proper construction of belting for each individual condition.

Since our engineers or G. T. M. men have about completed the plant analyses of all mills in this district, you are undoubtedly familiar with our unique method of merchandising.

Our policy, contrary to its critics, has proven not only beneficial to the purchaser, but is demanding increased equipment to manufacture rubber belting at the rate of nearly one million feet a month.

We believe it will interest you to know that a large percentage of our rubber belt salesmen calling on the trade are graduate engineers or are under the immediate direction of a mechanical engineer, giving his entire time to transmission problems.

Opposition due to unsatisfactory experience with indifferent kinds of fabric and cheaply constructed rubber belting is being overcome. Hundreds of complete inventories or plant analyses of factories and mill conditions have been placed in the hands of the operators in the interest of correct aplication, and at a net saving over adjustments due to misapplication.

Rubber belt long considered merely a substitute is forcing itself into first place as a power transmission. Properly selected, manufactured and applied it is simply, honestly and positively economically satisfactory. It is proof against everything except misapplication, a thing which with your co-operation we mean to eliminate.

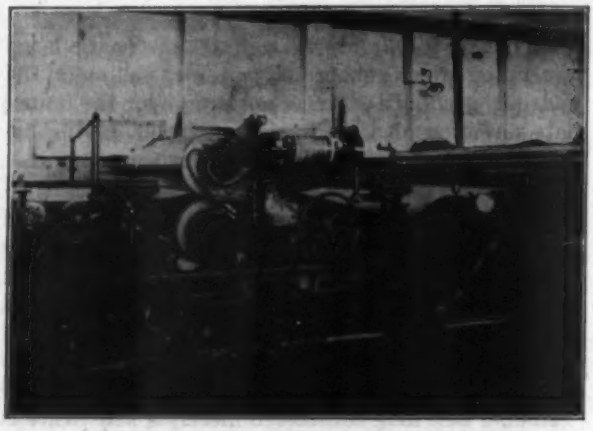
The adoption of a standard high-grade rubber belt will demonstrate that you can secure maximum service at minimum cost.

Suction Rolls

By LESTER E. MILKEY

A NUMBER of changes and improvements have been made in the design of the Fourdrinier paper machine during the past few decades. Like in other industries, necessity has been responsible for many of them, for with the demand for wider and faster machines for the purpose of making more and better paper at a profit, there came new conditions that required methods and equipment more efficient than those in use on the small and slow machines of the early days.

One of the important changes that took place came about through the introduction of Revolving Suction Rolls some years ago. By Suction Rolls is meant the



A typical installation of Suction Rolls

Suction Couch Roll and the Suction Press Roll. These are now in quite general use, both in this country and abroad, some of them on machines operating at speeds above 800 feet per minute and making practically all grades of paper. Their use has also affected the design of new machines, especially those intended for very high speeds on light weight papers. There are in operation machines built for this purpose which have on them no other couch or press rolls aside from those of the Suction type.

The idea of a Suction Couch Roll is about as old as the Fourdrinier machine itself. Mechanical difficulties of design we are told, prevented it from being incorporated in the second Fourdrinier machine that was built. It was not until about 1908, however, that a Revolving Suction Couch Roll was built and installed that would operate successfully. One of the factors in the success of the Suction Couch Roll was the rotary cycloidal vacuum pump which also came into use in paper mill work about that time. The Suction Press Roll was brought out a few years later and proved to be equally as important as the Suction Couch Roll.

The operating principle of suction rolls is a simple one, but the application of this principle is not quite so generally understood, even by some of those who are using suction rolls extensively. In order to properly understand this, it is necessary to have in mind the elementary principles of the paper machine.

After the sheet or web of paper has been formed on the Fourdrinier wire, the essential remaining problem, so far as the paper machine is concerned, is largely one of removing the water that is held in suspension with or in the paper fibres. This involves the separation and withdrawal of vast quantities of water from the solid matter that makes up the finished sheet of dry paper. An idea of the quantity will be gained from the fact that for each 2,000 pounds of prepared and diluted stock flowing on to the wire over the breast roll, about 1955 pounds or 97 per cent of this original weight in water must be eliminated before the sheet of paper reaches the dryers. Although the greater part of this is removed on the wire by gravity and by the capillary attraction of the table rolls, large quantities of it must also be removed by the Couch and Press Rolls through the application of pressure.

There are different ways of applying this necessary pressure and it will be conceded that upon the method employed, largely depends the character of the finished paper, and its rate of production as a salable product. Especially with modern machines operating at relatively high speeds, it is evident that the water must be taken out of the newly formed

Two of the Suction Couch Rolls operating on Hammermill Bond

sheet very rapidly; yet experience has proven that if this is done violently, the formation and strength of the sheet suffer accordingly and all too numerous breaks are caused.

In the old style couch or press rolls, all the necessary pressure is exerted by the top roll on its line of contact with the accompanying bottom roll. This

line of contact is very narrow, and since the resulting pressure is tremendous per unit of contact area, the water is violently forced from the web of paper as it passes between the rolls. A derangement of the fibres and a partial breaking down of the fibrous structure that has been carefully built upon the wire can hardly be avoided. There are many visible evidences of this harsh treatment that every paper maker is familiar with, such as crushing, wire and felt marks and blurred water or laid marks.

With the suction roll, mechanical line pressure is replaced by the atmospheric pressure which Nature has provided us with. This pressure, which may reach a maximum of 14.7 pounds per square inch at sea level, is constant and uniform and is applied by the suction roll to a controllable unit of area on the moist paper. Instead of a great pressure on a narrow contact, there is a lighter and milder pressure but distributed over a greater area. This lighter pressure in itself might not cause the removal of quite as much water as is possible to take out with the old style top and bottom couch rolls when heavily weighted, but another important factor enters into the operation. A considerable volume of air passes through the moist sheet into the suction roll and pump, and in so doing, carries with it either by absorption or as free water, additional moisture. Under these combined treatments, the necessary amount of moisture is removed uniformly and without disturbing or deranging the paper fibres.

The construction of the suction rolls and usual method of installation is shown in the accompanying line drawing. The stationary suction chamber "B" is connected to a powerful rotary vacuum pump usually located in the basement and driven from the constant speed line shaft. The contact between the suction chamber and the inside surface of the revolving shell "A" is made with special hydraulic packing. A deckel arrangement is provided for adjusting the length of the suction area to accommodate any width of sheet made on the machine.

The Suction Couch roll eliminates entirely the use of the old top couch roll with its felt jacket and guard-board, both of which require constant attention and are directly responsible for many of the machine tenders' troubles, such as crushing, wet streaks, wire marking, pick-ups and accidents to wires. The Suction Couch roll does not displace all of the regular flat suction boxes on the wire. In many cases the number of flat boxes used may be reduced, or what is equivalent, the degree of vacuum carried on them lessened. The degree of vacuum that may be maintained at the Suction Couch roll in operation largely depends upon the weight and character of paper

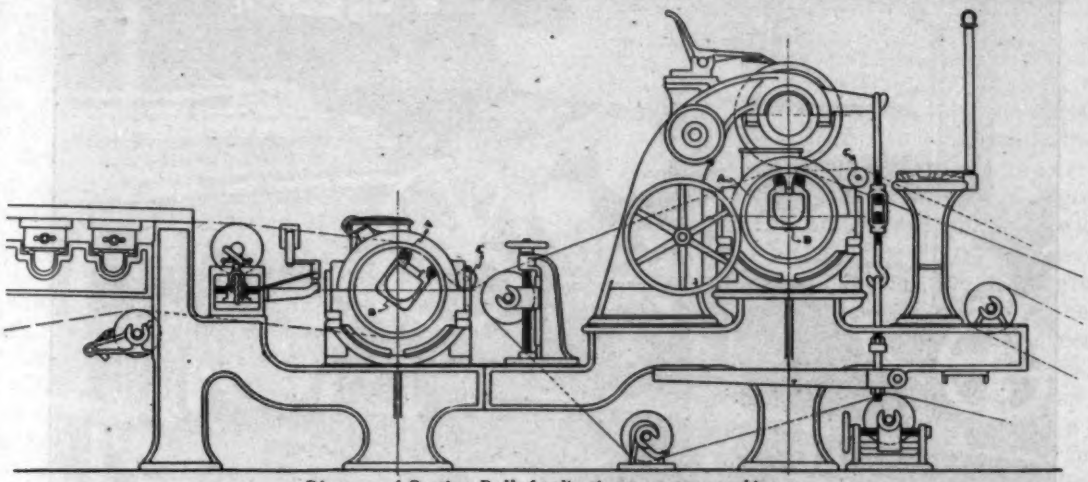
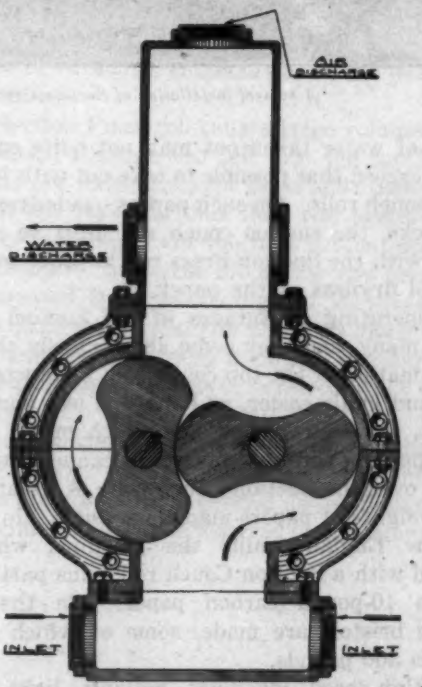


Diagram of Suction Roll Application to paper machine



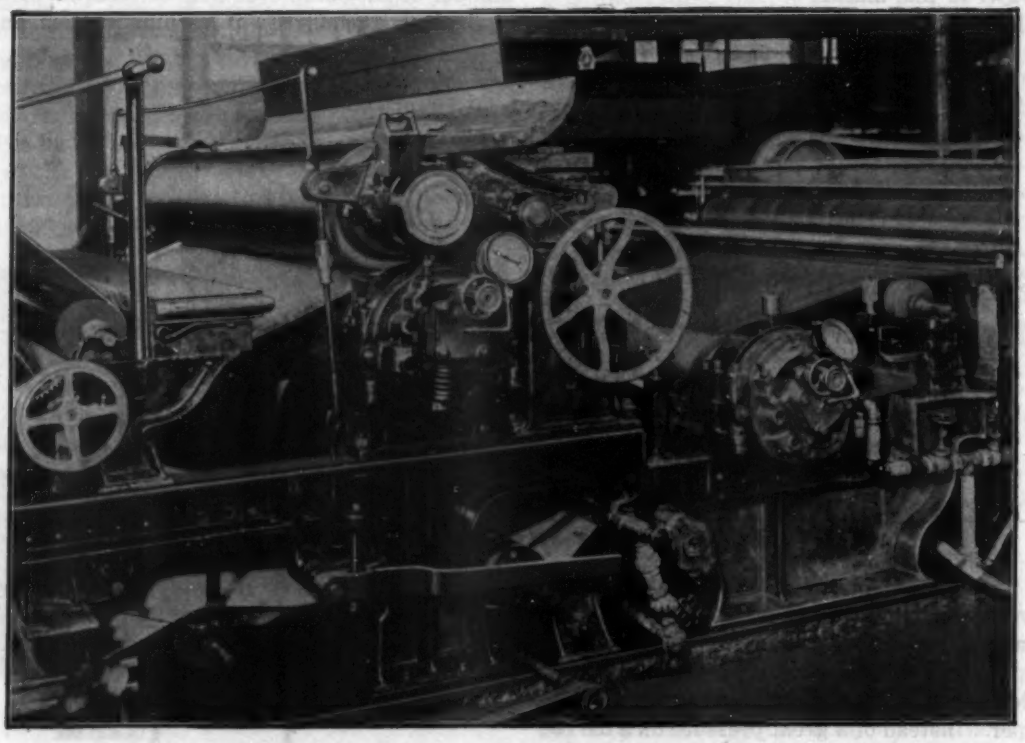
A cross section of the Rotary Cycloid Vacuum Pump especially designed for Suction Rolls

made. Likewise the per cent of water that may be removed by the Suction Couch roll also varies but to a larger extent this is proportional to the degree of hydration which the stock undergoes in its preparatory treatment. This accounts for the fact that on extremely slow stocks like grease-proof and Glassine, the paper may be delivered from the Suction Couch roll as much as 25 per cent bone dry, whereas with quickly beaten stocks like News and Fibres, the amount of water taken out may not quite equal or at least exceed that possible to take out with top and bottom couch rolls. On such papers, made from very free stocks, the suction couch roll must be supplemented with the Suction Press roll in order to effect increased dryness of the paper.

The operating advantages of the Suction Couch roll are many, and they come about chiefly through the elimination of the top couch roll. The wires run longer and guide easier, and there is less danger of accident, since foreign objects which might ruin a wire in passing through couch rolls cannot cause any damage over the Suction Couch roll. A great range in the weights of papers made is possible. In one of the New England mills the machine, which is equipped with a Suction Couch roll, runs part of the time on 10-pound carbon paper. On the same machine bristols are made, some of which are as heavy as 300 pounds.

On high-speed machines making light-weight papers the Suction Couch roll is fitted with a device for pneumatically carrying the sheet from the couch to the first felt when starting up.

Suction Couch rolls are especially adaptable to making book, writing and similar papers, as is shown by the fact that most of such papers are so made. When used in conjunction with the Suction Press roll, the Suction Couch roll may successfully be used on any grade of paper with the exception of very light cigarette papers and a few pigment colored papers of bright tints. In the former case, the paper is so light that the atmospheric pressure is sufficient to pierce the moist sheet, making it unfit for the purpose intended.



A typical installation of Suction Couch and Suction Press Rolls on a Fourdrinier Machine

Much has been said and written concerning the use of a Suction Couch roll on colored papers. The real fact of the matter is that when Aniline colors are used the suction roll does not produce a lighter shade on the wire side of the sheet, nor does it have any tendency to do so. Since most mills use Aniline colors exclusively, the question of color hardly enters into the subject. When pigment colors (which in reality are nothing more than fillers), are used, it is impossible to produce with any equipment on the machine a sheet that does not show a visible difference of shade in the two sides of the sheet. This is true whether or not a Suction Couch roll is used, but if the degree of vacuum on the suction roll is carried excessively high, it is possible to aggravate the two-sided effect. It is interesting to note that during the second and third years of the war many mills

using Suction Couch rolls found their regular supply of Aniline colors cut off and had to resort to the use of pigments. Yet, so far as the writer is aware, no difficulty was experienced because of this in any such mills making these colored papers.

The Suction Press roll is usually installed as the bottom roll in the first pair of presses on the machine. It is particularly adapted to such papers as News, Fibres, Kraft, sulphite bonds and Wrapping, which are made at high speeds and from free stocks. Several functions are performed, all of which are very valuable to the operation and production of the machine.

Anyone who has observed the operation of a pair of plain press rolls has noticed the pond of water at the nip of the rolls caused by the inability of this water to escape after being pressed out by the top roll. The upcoming surface of the bottom roll constantly carries the water back into the nip of the rolls and the faster the machine operates the greater this tendency becomes. The presence of the pond of water is extremely detrimental, since it requires the already partially dry paper and felt to pass through a bath of unclean water and this at the same time it undergoes pressing intended to remove more water. Many attempts have been made in the past to overcome this inherent and objectionable feature of plain press rolls. Slices of various kinds were tried out, but the ever-present danger of the slices getting into the press rolls made their use impractical.

The Suction press roll maintains a dry nip at the rolls because the water pressed out by the top roll and by atmospheric pressure is instantly removed through the suction roll and pump. With the elimination of the water at the nip, there is also eliminated many of the troubles encountered by the papermaker, such as crushing, blowing, felt-marking and breaking.

It is but a natural conclusion that the Suction Press roll should be capable of taking more water out of the sheet and felt than plain press rolls, and this is what actually happens. In some instances where dry tests have been made the sheet has left the Suction Press roll from 5 to 8 per cent dryer. It has been found that a wood top roll is very well suited for the purpose, but it is not weighted ordinarily because the roll itself is heavy enough to exert the necessary pressure with which atmospheric pressure is combined. It is obvious from this that the sheet in passing through a Suction Press is not subjected to harsh mechanical pressing, such as takes place with plain press rolls. This accounts for the fact that a better strength test is obtained on papers so made.

At this point it may be stated that thus far Suction Press rolls have not been used to any great extent on soft book papers because of the tendency of such sheets to show a marking corresponding to the perforations in the suction press roll shell, although it has been demonstrated that with the use of proper felts and a favorable manipulation of other plain press rolls on the machine it is possible to eliminate the marking. Much depends on local machine conditions.

Probably one of the most important features of the Suction Press roll is its ability to prevent press breaks. In the conventional presses, the sheet has a natural tendency to stick and follow up on the top press roll. It is separated from the top press roll by the pull of the felt and if the force required is greater than the strength of the sheet, the latter will invariably break. The sheet is very tender at this point, and in no case is its strength much greater than the pull necessary to loosen it from the top press roll; therefore, any small lumps or imperfections in the stock decrease the strength to the breaking point. Much production is lost in press breaks and, of course, broke is not a salable product. In a Suction Press roll the tender sheet is held down to the felt by atmospheric pressure, which is sufficient to overcome any tendency of the paper to stick to the top roll. Safe running results in increased production and permits higher operating speeds. Operating records are available on suction roll equipped machines operating at 600 feet per minute which shows that the machines are frequently operated for an entire week without a single break on the wet end of the machine.

The Suction Press roll causes large volumes of air to be passed through the felt into the suction roll. The felts are naturally kept open and clean in this way and the result is that they run longer before requiring replacing. On the first suction press roll installation ever made the life of the first press felts was increased from an average of 9.7 days to an average of 25 days. Many of the mills using suction press rolls have first press felts that are napped on one side only, inasmuch as it is unnecessary to turn them over.

Although this description of suction rolls has been confined to their use on Fourdrinier machines, suction rolls are also in quite general use on Cylinder and Wet machines and will be referred to in a later article.

A Few Notes on the Manufacture of Box Board

By B. M. BAXTER, Engineer and Mill Architect

IN THE following remarks on the manufacture of "Box Board," the term in general is used in connection with such grades of board as plain chip, single or double liner chip, solid news, and similar grades. The manufacture of such special grades as container, jute board, test board, etc., involves somewhat different treatment and the power consumption is somewhat different and will be covered in a subsequent article.

The grades of stock used most generally are mixed papers, folded news, overissue news, news blanks, box cuttings, etc., with a limited use of shavings, groundwood, manilas, etc., and bleached and unbleached sulphite mainly for liners, the grade of stock used being dependent upon the kind of liner specified and to some extent upon the required bending quality of the finished board which is to a large degree dependent upon the strength of the liner.

The Stock Used

As all these kinds of stock are furnished directly into the beater, the process of manufacture does not involve any preliminary reduction of the stock into "half stuff," as is required in the manufacture of fine rag papers, rope and burlap sheets, etc., nor any digesting or washing as in the manufacture of book papers from magazine stock. To this extent, the manufacture of box board is simpler.

In general, the stock is brought into the beater room in bales as received, the bales broken and the stock furnished directly to the beaters, but there is little doubt that a suitable sorting and screening system would be a valuable auxiliary, enabling quicker furnishing of the beaters, the removal of considerable dirt, pieces of metal, rags, strings, etc., which would better be removed beforehand than later and reducing wear and tear on beaters and jordans. That such systems are not in general use is probably due to the large amount of material required to be handled.

Beater Room Practice

The treatment of the stock in the beaters varies considerably, some mills merely brushing it out and depending mainly on the jordans for refining. This has in some instances been carried to the point of operating the beaters without bed plates. Such treatment, while making possible rapid dumping of beaters does not produce as good board as more thorough beating.

The use of hot water for beater furnish is very advantageous and is common practice, but there is no generally accepted standard for the best temperature. It is probable that there is no particular advantage in using water excessively hot beyond more rapid reparation of the fibre, and it is quite likely that high temperature leads to the extraction of a certain amount of the lignin of the ground wood, which is the major constituent of the stock used.

The speed of the beaters—rim speed of rolls—in general, seems to be considerably higher than that employed for making book, bonds and similar sheets, since hydration of the stock is not required and the time element is not involved to anything like the same extent, while the higher roll speed gives quicker preparation. It is of quite general practice to cut down a certain number of flybars, divided equally around the roll, to enable more rapid furnishing with less plugging of the roll.

The treatment of the liner stock, of course, varies widely, according to the kind of stock used, and would naturally have to be quite different when handling hard ledger shavings or sulphite than when beating news blanks or manilas.

Types of Beaters Used

The beaters used are almost invariably iron tub engines. Until recently the sizes employed have been smaller than used in other lines of paper manufacture. This is accounted for, because of the desirability of equipping a mill with sufficient beaters to make liner board economically. If the number of beaters were small, and the capacity large relative to the tonnage of the mill, it would be difficult to run small orders of liner board without running an unnecessarily thick liner compound of more costly stock.

In the past the most common beater size used has been the 1,000-lb., but in the newer mills 1,200-lb. and 1,500-lb. beaters are more frequently found. The selection of beaters is, however, largely a matter of the machine capacity and grades intended to be made. It is the writer's personal opinion, that for a mill equipped to make a considerable range of product, not fewer than six beaters should be installed down to a point of so small machine capacity, as to make the beater sizes all but impractically small. The foregoing applies only to the manufacture of

liner board. For a mill fitted to make plain chip, solid news, etc., this has less bearing, but is nevertheless desirable, as even in such grades a more desirable product can be made.

Continuous beaters are coming into quite general use where large capacity is desired and where the stock from such beaters goes directly to the jordans. Some mills have found that with sufficiently small perforations of the screen plates to obtain the degree of refinement desired, the capacity is considerably increased.

Capacity of Beaters

The ratio of capacity of beaters to machine production varies quite widely, probably due to an increase in machine capacity without a corresponding increase in beating capacity. As in most other lines of paper manufacture, proper beating is essential to produce a quality sheet and overcrowding of beaters is certain to be detrimental. A figure of seven and one-half tons per day for a 1,200-lb. beater is quite conservative and allows considerable margin for an increase in output. This applies to filler beaters; liner beaters must be proportioned according to the requirements of the stock to be used.

The Jordan Engines

Jordans have generally been rather smaller than used in other lines of manufacture, for the same reason as before mentioned, namely, that necessity of separate handling of liner stock. There seems to be no accepted standard for Jordan speeds and the writer has seen them running all the way from 375 R.P.M. to 500 R.P.M. This naturally would vary to some extent with the size used and diameters of the plug, but seems more to be a matter of the personal equation and the ideas of individual superintendents.

Due to the kind of stock handled and presence of pieces of metal, the wear and tear of Jordans is quite severe and it is always desirable to have a spare Jordan in reserve and several spare plugs.

Chests and Screens

Chests are usually of the horizontal type. Both concrete and wood are commonly used, although concrete chests are subject to the accumulation of slime unless tile lined or the inside surface otherwise prepared to avoid it.

The standard and almost universal screen arrangement is an individual screen for each cylinder, as by this arrangement the regulation of thickness of stock deposited upon individual cylinders is much more simplified. For liner stock it is, of course, essential to have separate screens.

There seems to be considerable latitude in screen sizes, and eight, ten and twelve-plate screens are found on machines of nearly equal width. Diaphragm screens seem to be used entirely.

An arrangement of screens frequently adopted is that of directly coupling the camshafts of an entire line with a single drive. This is apparently merely a matter of mechanical convenience. Individual drives are preferable from a theoretical standpoint, since each camshaft has only to transmit the power required by one screen—in the coupled arrangement the shaft carrying the driving pulley has to transmit the power of all others to the end of the line and in case of the failure of this shaft the machine would be down, while with individual drives, one cylinder, fed by the screen affected, might be "jumped" and operation resumed with perhaps a change of order better adapted to suit the emergency.

The Cylinder Machines

Box board machines are of the multiple cylinder type, the number of cylinders varying from four to seven ordinarily, although light-weight board can be made on fewer cylinders. The larger number of cylinders, better adapted to manufacture of the heavier weights, make it possible to get better formation and higher speeds. Since the thickness of stock which can be deposited on a cylinder is determined by the difference in level of stock outside and water inside or "suction," the "freeness" or "slowness" of the stock, and the length of time of immersion of any given point on the cylinder face in the stock during a revolution, it seems probable that as box board machines are developed further, cylinders of larger diameter will be used.

Whether or not liner board is to be made to any considerable extent, has a great deal of bearing on the desirable number of cylinders. As the liner stock is more expensive than filler stock, economy requires that the liner be kept as thin as circumstances permit which necessitates an ample number of filler cylinders to attain reasonable machine speed.

Suction and Press Rolls

Primary presses vary in number from four to seven sets, probably one set for each cylinder would strike a fair average. One roll of each set is usually rubber covered. Presses are usually brass for the upper roll, the lower roll rubber covered. In many of the older machines two presses are used, three is the most common number, although four occasionally are used. A fourth press is undoubtedly of value in case any live steam is customarily used in drying, but more capacity is obtained if drying is done entirely by exhaust steam and then utilizing any surplus, by substituting for the space taken by a fourth press and the cost of it, by the additional drying capacity of several dryers.

Suction rolls are finding favor and the use of them is increasing. Increased production or lessened press pressure may be obtained, the latter lessening the tendency of felt marks in the sheet.

Dryers

The number of dryers installed is almost always the limiting factor of machine production in the me-

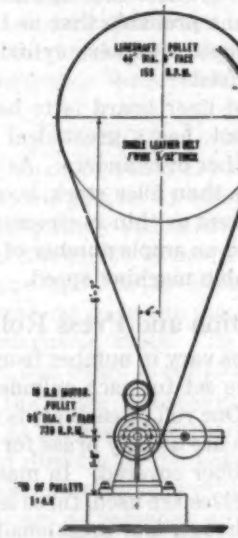
(*Continued on page 876*)

Modern Belt Drives

By VIGGO SAHMEL

THE ideal belt drive is, without question, a horizontal drive, or one as nearly horizontal as convenient, where the ratio between the pulley diameters is not too great, where the horizontal distance between the pulley centers is so great that the mere weight of the slack side of the belt, which of course should be the upper strand of the belt, is sufficient to prevent the belt from slipping when transmitting full horsepower, or better, the maximum horsepower expected. When laying out drives of this type, it is found that the capacity of the belt drive is greatly increased by keeping the slack side of the belt so slack that it almost touches the tight or pulling side. If this type of drive should be caused to operate with a considerable tension in the slack side, the capacity would be reduced, the reason for this being the loss in arc of contact on the two pulleys due to the tight belt as compared with the slack belt.

Nowadays, economy in floor space, belting, first



Vertical Drive

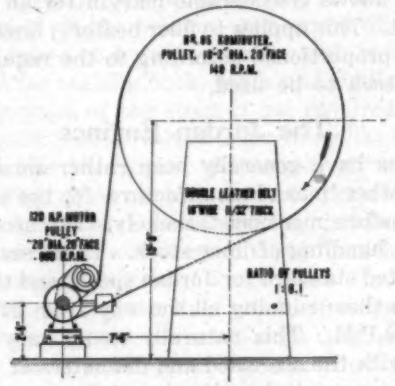
cost of equipment and all-over efficiency is so vital that direct-connected units, geared units, and chain-driven units have been considered the only salvation from the old-fashioned long center belt drives. Lately, however, the so-called LENIX belt drive or, belt drives involving the use of the Lenix principle, has come more and more into favor, as will be explained more in detail in the following.

History

The word LENIX is coined from the first syllable of the proper name Leneveu and from the Roman numerals IX. Capt. Leneveu, an officer of the French Artillery, was the first to introduce on a successful commercial basis the scientific and correct application of the flexible or resilient idler pulley, also termed belt wrapper. The Roman numeral IX stands for the following nine good points about the Lenix Drive:

1. High efficiency.
2. Low first cost.
3. Low maintenance cost.
4. Low rate of depreciation.
5. Simplicity of design.
6. Noiselessness.
7. Shock absorbing qualities.
8. High ratio of transmission.
9. Freedom in selection of location of pulleys.

The Lenix Drive is now well known all over the world and, of course, particularly well in France, Bel-



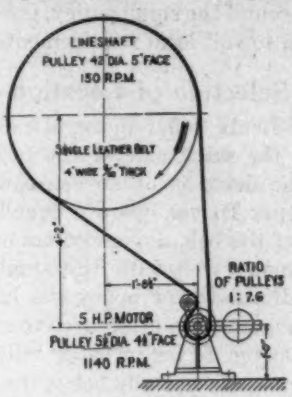
45° Lenix Drive

gium, Italy and Germany, where various companies acquired the necessary rights from Capt. Leneveu. For this continent all rights and engineering data were obtained by the firm of F. L. Smidth & Co., New York City, the sole manufacturers of the Lenix Drive.

High Efficiency

The reason for the high efficiency of the Lenix Drive is found in the fact that all belt slippage has been eliminated, except, of course, the natural belt creep amounting to 0.5 to 1 per cent. This creep is incidental to the elastic nature of the belt and because the belt enters the pulley under tension, but leaves the pulley practically without any tension. This, of course, results in a contraction of the belt while passing around the pulley and a corresponding slip or creep between the belt and the pulley. A second reason for the high efficiency of the Lenix Drive is found in the fact that with the large arcs of contact of the driving and driven pulley incidental to the Lenix Drive, it is possible to reduce the tension in the slack side of the belt to a point where it will barely prevent the slippage of the belt; in other words, the same con-

dition found on the old-fashioned long center belt drive mentioned under the introduction of this article. Inasmuch as each pound of tension eliminated from the slack side also disappears from the tight side of the belt, the resulting bearing pressures in the shafts of the driving and driven pulleys are greatly reduced. As compared with short center open drives where



Steep Drive

high initial tensions are imperative, the bearing pressures are cut in half.

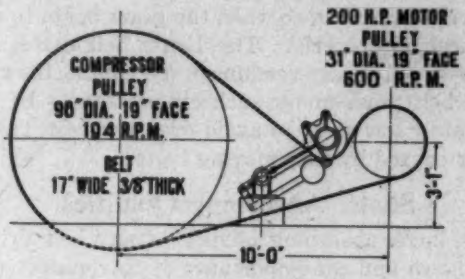
Another source of efficiency incidental to the Lenix Drive is found in the fact that high speed motors or generators may be used to advantage. This point, however, will be further treated under the heading "Low First Cost" and "High Ratio of Transmission."

Low First Cost

Because of the short centers between the driving and driven pulleys which are not only possible but also desirable, the cost of belting is cut in half. To this, of course, must be added that the travel of the belt in feet or miles per year also becomes double for the same number of hours of operation, or rather the number of times the belt is bent around the pulleys. In spite of this, however, the life of short-center Lenix Drives compares favorably with that of long-center open drives. Because of the reduced bearing pressures mentioned under "High Efficiency" it is possible to use two-bearing motors or generators in many cases where it would be deemed expedient to use three-bearing units. The saving in first-cost due to the elimination of a third bearing is considerable and may even run as high as from 10 to 20 per cent of the total price of large motors. A further saving is possible by the use of high-speed motors or generators, as explained further under the heading "High Ratio of Transmission."

Low Maintenance Cost

The only part of the Lenix Drive subject to any wear to speak of is, of course, the belt. The wear



Typical Compressor Drive

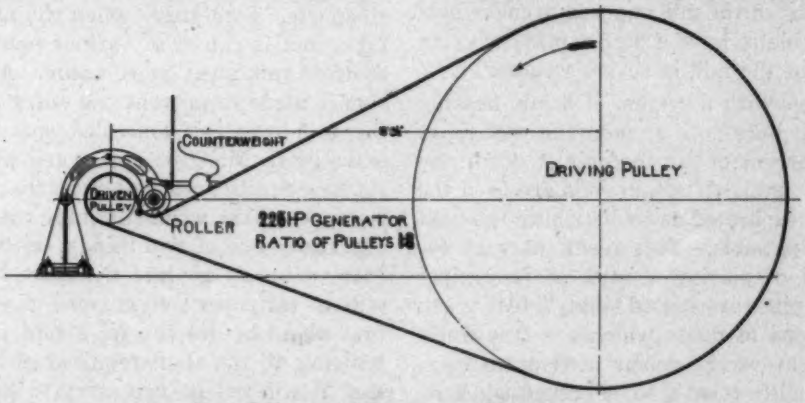
in the bearings of the Lenix roller, when properly lubricated, will be practically negligible and considerably less than that of the bearings of the driving or driven unit. This point should be kept in mind when comparing with gear or chain drives.

Low Rate of Depreciation

Because of the policy of ruggedness in the design of the Lenix Drive, the rate of depreciation does hardly enter and should be put at least equal to that of, for instance, a motor or a generator.

Simplicity of Design

The design of the Lenix Drive is so simple and the instructions for its installation equally so that they may be successfully mounted and put in service by any ordinary skilled mechanic able to read the instructions and the blueprints. The greatest trouble, however, is found in the fact that because of the ap-



Typical Horizontal Generator or Motor Drive

parent simplicity of the Lenix, certain fundamentals are often violated in its application, at times with disastrous results where large horsepower is involved.

Noiselessness

Because all flapping and slippage of the belt are eliminated the Lenix Drive becomes real noiseless and makes it well adapted, for instance, on ventilating fan drives where any hum is readily carried along with the ventilating air to offices or auditoriums where noiselessness is of the greatest importance. Whereas, gear drives and chain drives may operate noiselessly when they are new and mesh perfectly, they will not remain so when the gears begin to wear and mesh improperly. The Lenix belt drive, once noiseless, will always remain so. Of course, the speed of the belt must under such circumstances be kept moderately low so as to avoid even the faint rush in the air caused by fast moving belts.

Shock Absorbing Qualities

The shock absorbing quality of any belt drive is well known and the importance of this quality often makes it necessary to insert so-called flexible couplings on direct driven units, gear driven units or even chain driven units. With the Lenix Drive, the compactness of a chain or gear driven unit is thus combined with the elasticity of a belt drive. This has caused the Lenix Drive to be used to a great extent on compressor drives and various drives in the paper industry. In particular, on beater drives, washing and Jordan engines.

High Ratio of Transmission

The Lenix Drive permits of high pulley ratios combined with short centers. Pulley ratio of 1:10 is not unusual and this will thus permit the use of a, say, 1200 R.P.M. motor to be belted directly to a shaft operating at 120 R.P.M. This step in power transmission is the most difficult one, because any further reduction in the speed can easily be obtained, using inexpensive gears. As long as the Lenix belt wrapper takes care of the proper arc of contact of the belt when passing around the small pulley, the large pulley may be selected to suit local requirements.

Freedom in Selection of Location of Pulleys

Because the Lenix roller automatically regulates the tension in the slack side of the belt drive, the direction of the drive is of no consequence. This means that Lenix Drives operate equally well with the tight side of the belt top or bottom on horizontal drives, and equally well with the small pulley arranged vertically above or below the larger pulley. The latter arrangement is often used to advantage on group driven beater drives in paper mills where the lineshaft is arranged vertically below the shaft of the beater pulleys. The Lenix device is then operated by means of a hoisting rig from the beater floor in such a way that when it is desired to stop the beater the Lenix is thrown back. When it is desired to start up the beater, the Lenix is thrown slowly back so as to engage the full width of the belt with the driving pulley. It will be readily seen that this starting service is very much better for the belt than the ordinary loose and tight pulley arrangement where the full starting load is to be carried by the one edge of the belt and the other edge badly bruised by the pressure of the belt shifting fork. The various diagrams of this article indicate the great possibilities with this, the modern belt drive.

(*Continued from Page* 839)

help if a third main supply pipe extended down the center of the mill. If it happened that the supply pipes ended in a part of the mill exposed to cold winds it would be advisable to have a pipe supplying extra heat to this part of the mill in severe weather.

The disadvantage with a system of steam heating is that if moist air once gets up next the roof there is no incoming current of air to force it down and carry it out of the mill. If steam coils are used the pipes should be so separated as to distribute the heat as uniformily as possible. This result may be obtained if, instead of placing a bank of four pipes every 20 feet, the pipes are spaced singly 5 feet apart. In the neighborhood of doors which are frequently opened in cold weather the rooms need extra heating if moisture condensation is to be prevented there.

Pitch of the Roof

The pitch of the roof has a certain bearing in regard to the heating, since the less the pitch the easier it will be to keep the heat evenly distributed to all parts of it. The less the pitch, the less surface there is for heat loss through the roof. At the same time less material is required to build a flat roof than a steep one. Sometimes when the pitch is very low a false roof is raised at various points in the gutters to drain rain away more easily. As a rule no provision is made to prevent the entry of moist air from the mill into the concealed space formed by this extra roof. Moisture enters and within a short time rot develops to such an extent that it is necessary to renew all of the wood adjoining the space. The remedy lies in one of two things: either preventing the entry of moist air into the space by putting several plies of tar paper well mopped together on top of the first plank before the false roof is built, or else in building all the slant required in the first planks so that it will not be necessary to have any concealed spaces at all. The latter would be most satisfactory in the end, although it would require more framing in the supports for the roof as well as a greater cutting of planks, which are used in the roof.

(*Part Two will appear in February number*)

The Grinding of Paper and Pulp Knives

By R. D. BALDWIN
Simonds Manufacturing Co.

IF THIS article brings a few useful suggestions to the trade and emphasizes the need of care in knife grinding it will have served its purpose. The life of a good knife depends largely upon proper grinding.

Chipper knives should be ground on heavy, rigid grinding machines, preferably wet, using either the cup or straight wheel. Because the steel in barker knives is usually a trifle harder than in chipper knives, care must be taken that the wheels are not too hard in order to prevent glazing and burning. Paper knives are ground satisfactorily on a number of different types of knife grinding machines with both cup and straight wheels.

Chipper and barker knives—in fact, all classes of knives used for wood cutting—may be ground with either a cup or a straight wheel. It is our experience, however, that the cup wheel is used in the majority of cases. One advantage of the cup wheel over the disc wheel is the fact that it operates at a constant surface speed in wearing down; hence the same grinding action is obtained from the start to the finish. It is also known that too much concavity will weaken the edge of a knife of any kind. Therefore, as chipper and barker knives are subjected to such severe service, most mechanics prefer the straight bevel, such as is secured with the cup wheel.

In general, the correct surface speed for grinding wheels used on knife grinding operations is from 3,500 to 4,500 surface feet per minute. In the case of the straight wheel it would probably be advisable to operate the new wheel at the maximum of 4,500 surface feet per minute in order that the speed will not be reduced too much as the wheel wears down. The grade of the wheel will have to be selected with this in mind.

Hardened and tempered carbon steel knives should always be ground wet. If they are ground dry there is great chance of drawing the temper, unless the grinding is done very slowly and carefully. It would probably not be good production grinding to grind these knives dry. An insufficient supply of water is dangerous because of the possibility of softening the edge of the knives in spots. Of course, if water is used it should be used liberally so that the temperature of the knife being ground is uniform from one end to the other. It is not necessary to eliminate the heat generated in grinding entirely, even if this could be done, but the purpose of the lubricant is to keep the temperature of the knife the same from one end to the other and also to keep the wheel face open and free cutting.

There are good lubricants on the market, one part of which should be used to 40 parts of water by volume. A home-made lubricant is one gallon of lard oil to 40 gallons of water, with the addition of about one-half gallon of bicarbonate of soda. The purpose of the soda is merely to prevent the water rusting the grinding machine. The compound is not good if it is made too thick and oily, as the pores of the wheel will then be filled up and the wheel will glaze and not cut freely.

The grade of wheel used in grinding knives is of prime importance in order to secure the best results. The following wheels made by the Norton Company of Worcester, Mass., are recommended:

For Chipper Knives:

Cup wheel	6636-J	Silicate Process
Cup wheel	6630-K	Silicate Process
Straight wheel	6636-J	Silicate Process
Straight wheel	6636-K	Silicate Process

For Barker Knives:

Cup wheel	6636-J	Silicate Process
Cup wheel	6630-J	Silicate Process
Cup wheel	6636-I	Silicate Process
Straight wheel	6636-J	Silicate Process
Straight wheel	6636-I	Silicate Process

For Paper Knives:

On the Baldwin, Tuthill & Bolten knife grinders the following wheels have given satisfaction:

36x2 x24"	Straight Wheel—6636-J Silicate
12x4 x 1¼"	1¼" Rim, 1" Back—6630-I or J Silicate or Cup Wheel—6636-J Silicate
8x3½x 1"	1¼" Rim, 1" Back—6636-J Vitrified or Cup Wheel—Silicate
8x3½x 1"	⅞" Rim, ⅞" Back—6636-J Silicate Cup Wheel

On the Bridgeport knife grinders:

36x2 x24"	Straight Wheel—6636-I Silicate
24x8 x 3"	2" Rim, 1½" Back—6630-J Silicate Cup Wheel

On the Seybold knife grinder:

30x1⅛x16"	Straight Wheel—6630-J or K Silicate

On the Buffalo knife grinders:

6x3 x 1"	1" Rim, ¾" Back—6636-J Vitrified Cup Wheel

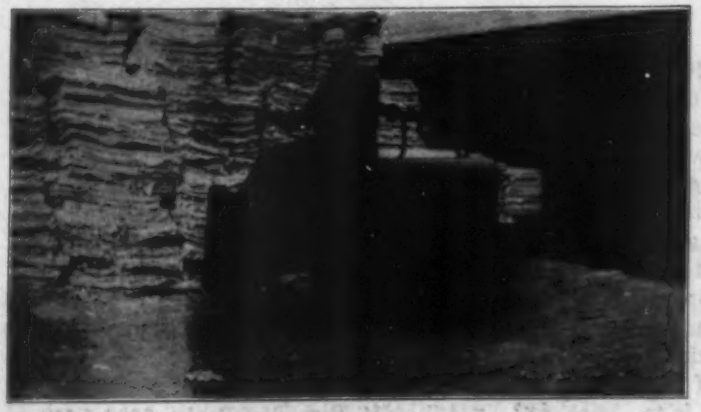
Practical Ways to Cut Costs and Set the Pace for Greater Production

Tried-out plans and methods which have proved successful in both large and small paper mills. Perhaps you have something better. If you think you have, send it in and give the other fellow a chance at it.

This method is very efficient on the Paper Machine

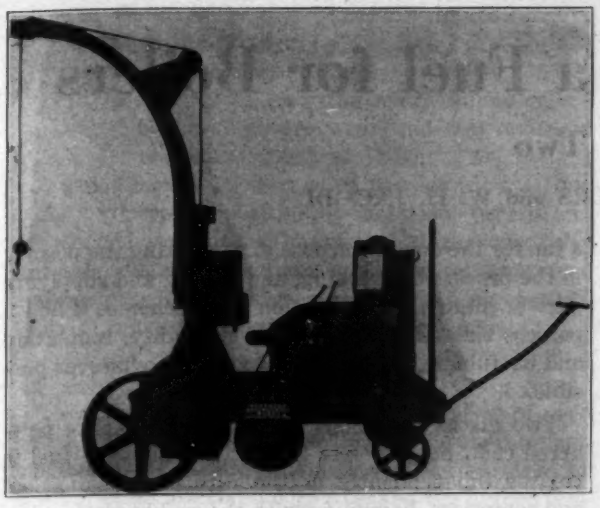
Unloading Wood Pulp for the Tidewater Paper Co.'s Mill at Brooklyn, N. Y.

Roll Paper is handled in this manner at the West Virginia Pulp and Paper Co.'s, Piedmont, Va.



The raw material and the finished "Marathon" Bond and other specialties are handled in this way

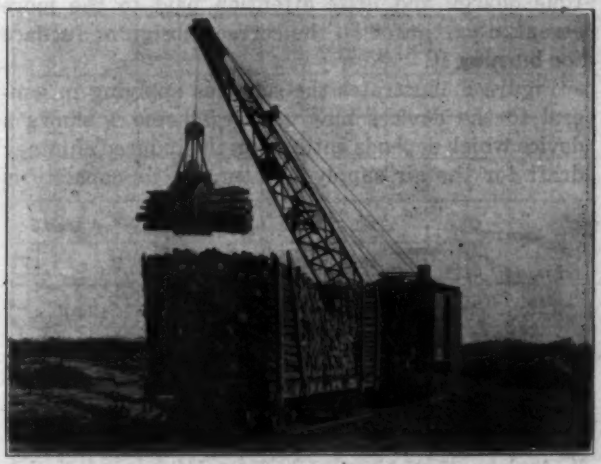
How they handle cases of paper at a large Terminal Warehouse



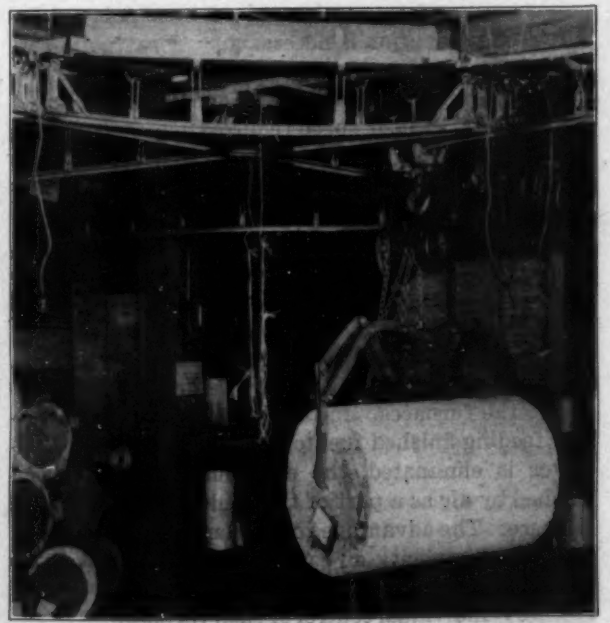
The portable Crane that has won the sobriquet of "The Millright's Friend"

Utilizing every inch of storage room in the Seaman Paper Co. Warehouse

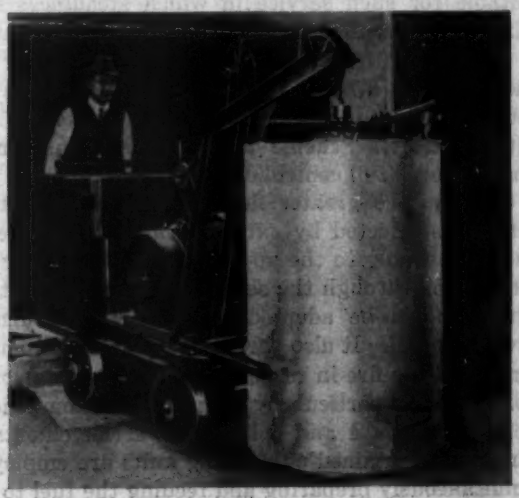
Equipment used by Oxford Paper Co. for handling Rolls



Locomotive Crane unloading Pulp Wood for the Combined Locks Paper Co.



The Egry Register Co., of Dayton, O., have found this an efficient method of handling Roll Paper



"The Largest Mail Order House in the World" unloads their Roll Paper in this manner

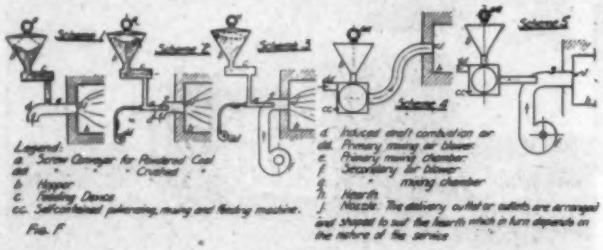
Powdered Coal as a Fuel for Boilers

Part Two

By EDWARD R. WELLES and W. H. JACOBI

UNDER the name of "burners," the devices that have been used to mix the necessary air and coal powder and feed the mixture to the hearth are numerous. Their merits are relative at best and each has its limitations; their only function being to convey, mix thoroughly and deliver the fuel charge to the hearth in the required quantity. In this connection it is interesting to note that up to the present time the merits and success of powdered coal have been based solely on the facility of providing the proper elements for perfect theoretical combustion. Accordingly much talent has been spent in creating devices for mixing and feeding the combustible charge and little attention paid to the more essential part, that is, the correct design of furnace for burning it.

Figure F illustrates the schemes applying in general to the devices now used. Scheme 1 shows a device which depends entirely on the induced chimney draft for the air supply. Naturally, its capacity is


Scheme 1
Scheme 2
Scheme 3
Scheme 4
Scheme 5
Legend
a Screw Conveyor for Powdered Coal
aa " " Crushed "
b Hopper
c Feeding Device
cc Self-contained pulverizing, mixing and feeding machine.
d Induced draft combustion air
dd Primary mixing air blower
e Primary mixing chamber
f Secondary air blower
g " mixing chamber
h Hearth
j Nozzle. The delivery outlet or outlets are arranged and shaped to suit the hearth which in turn depends on the nature of the service
FIG. F

limited by the chimney draft and its regulation is restricted to a small margin. This method would be suitable for such service in which steadiness is a minor consideration. Scheme 2 shows a combination of natural and forced draft which permits wider application than scheme 1; its regulating features are better, but still is subject to the fluctuations of the natural draft. Scheme 3 shows an arrangement which affords full control of the fuel and the air, and in consequence greater flexibility in its operation, being less affected by external variables. It lends itself admirably to the application of heated air for combustion through the secondary blower, a method which should be adopted exclusively for burning powdered coal. It also permits the use of automatic control of the fire in response to varying load conditions. This is particularly desirable in steam generation. Schemes 4 and 5 illustrate arrangements in which self-contained pulverizing units are employed, simultaneously preparing and feeding the fuel to the hearth. These machines are usually provided with a fan for the double purpose of separating the powder in the process of grinding, and mixing and supplying part or all of the combustion air. Schemes 3 and 5 possess the same merits as to flexibility, regulation and usefulness, and should be adopted wherever possible.

Two distinct methods are in use to prepare powdered coal; one involves a plant in which the fuel is treated independently of the rate of consumption, and comprises, beginning with the coal bunker and in the order of the operations: Crushers, Crushed Coal Hoppers, Dryers, Magnetic Separators, Pulverizers, Powdered Coal Storage Hoppers, Distributing Conveyor feeding individual Hoppers at each Furnace which are fitted with Feeding Devices, and a Blower or separate Blowers operating in conjunction with the Feeding Devices to mix and feed the fuel to the furnaces. The various apparatus are interconnected with suitable elevating or conveying means to conveniently carry out the cycle of operations, and permit of multiple arrangements to suit local conditions. The advantages of pulverizing plants are:

(a) Uniformity in the quality of the powder.
(b) Ample fuel supply to provide for varying loads and starting, without taxing the normal operation of the equipment.
(c) Suitability for large installations where uniform service and a central point of distribution is necessary.

The disadvantages are:

(a) High first and operating costs.
(b) Large floor space required.
(c) Multiplicity of equipment and parts.

The other method consists of self-contained pulverizing units, conveniently located near the point of fuel consumption, preparing the powder as required. Beginning with the coal bunker, the equipment comprizes: Crushers, Magnetic Separators, Crushed Coal Storage Hoppers, Distributing Conveyor feeding individual Hoppers at the Pulverizers, Pulverizers, Blower for combustion air and Feeding Devices leading to the furnaces. In the event of a single pulverizer feeding finished fuel to various furnaces the Conveyor is eliminated, the distribution being accomplished by air as a part of the feeding devices for the furnace. The advantages of this arrangement are:

(a) Simplicity of equipment and therefore low first and operating costs.
(b) Individual control of each furnace.
(c) Adaptability to existing plants.

(d) Good regulation without altering the quality of the powder.

The disadvantages are:

(a) Necessity of carrying spare units, on account of severe wear and tear when in continuous service.

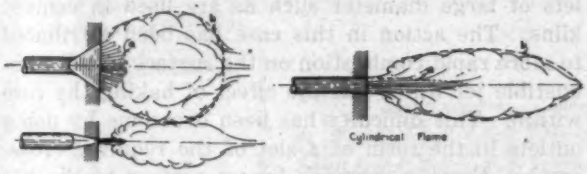
(b) Absence of storage of powder for starting.

As a general proposition, if conditions permit ample storage and suitable handling facilities to air-dry and mix the raw coal thoroughly the self-contained equipment offers greater possibilities both in flexibility of service and arrangement and economy.

Part II—Flames*

The flames resulting from the deflagration of powdered coal differs from the flames of other inflammables in the larger combustion space required on account of its low combustibility, and the higher temperature due to the rapid breaking up of the solid structure of the coal particles.

In general, the more inflammable the material or the lower the rate of oxidation, the smaller the space



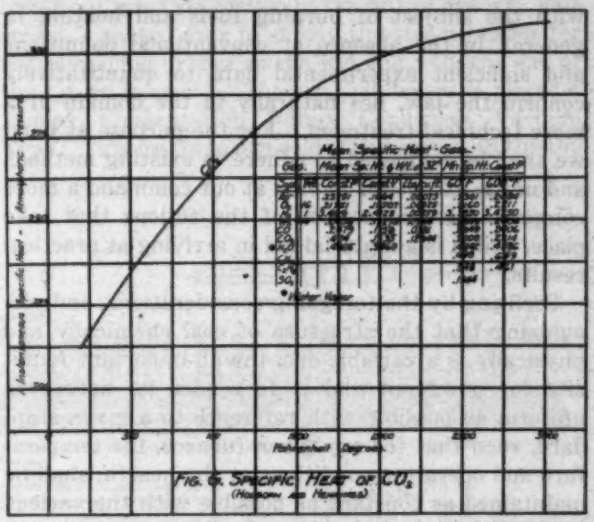
required for its combustion and the lower the average temperature that develops. This condition is shown by the performance of explosives and the slow burning of gas, oxidation of iron, etc. The average temperature of combustion of gases in ordinary air is from 1500 to 2000 degrees F., and for a given amount of fuel consumed, takes place in a smaller space than atomized oils, which begin to burn steadily at about 2000 degrees F., and experience shows that the deflagration of powdered coal requires a still larger space and the average temperatures developed by its combustion are much higher—2500 degrees and above.

Fuels are rendered more inflammable as they are brought to or carried beyond their ignition temperature, and they are more thoroughly mixed with the necessary oxygen.

Temperature, like voltage and pressure, is a difference of potential and, with reference to burning fuels and heating, is a measure of the relative molecular activity of the materials involved which can be expressed quantitatively in terms of $M V^2$. Reference to this phase of the dynamic theory of the formation of matter is made here merely to indicate the fundamental relationship between temperature, mass and the performance of the component material particles; so that for a given mass the measure (temperature) of thermal energy varies as the square of the molecular activity.

The truth of this is somewhat verified by the specific heat of materials which is not constant but increases, though not in proportion with the temperature, and in a manner which confirms that law. A long metal bar heated at one end up to melting point is another example showing similar temperature conditions at equal distances apart toward the cold end.

As yet, no definite values have been found to measure thermal energy in terms of $M V^2$ and for



the time being, the practical value of the conception of that law lies in the aid it lends in following the actions that take place during the combustion and heating, to determine with some precision truer thermal conditions and effects that may result.

Accepting that temperature is a function of the square of the activity of the particles of matter, it is easily conceived that the greater the molecular or atomic disturbance caused by the combination of oxygen and the combustible elements, the greater will be the temperature of combustion, though not directly proportional to, but as some function of the square of the rate of combination. If we then assign a constant value to the unit increment designated to measure temperature, as our present degrees, the heating of any given mass varies as some function of the square root of the applied temperature (the temperature difference between the heating medium and the mass to be heated)—and inversely as the mass. That is, heating is not directly proportional to the temperature applied as is ordinarily understood. This fact is conspicuously verified in metallurgical work where a wide range of temperatures obtain.

The part mass plays is also not a constant one,

* Flame is usually defined as the luminous or visible portion of the zone of deflagration. While this is the ordinary conception, in our case, by "flame" is meant the zone of oxidation, that is, the space within which the oxidation of the combustible elements is completed, which is much larger than the luminous zone, specially in the case of blast flames, such as obtain with oil, gas and powdered coal.

since the nature of its structure varies in all materials, and this condition must be looked to for the inconsistent results ordinarily observed in all heating operations. A practical solution of the difficulty is, however, not out of reach, for the similarity in performance in electric and thermal phenomena affords a way out. In this connection it may be briefly stated that within the range of temperatures that obtain in industrial applications, manifestations akin to resistance, inductance and capacity appear in the process of heating and it is possible to develop and introduce a term of the order of "power factor" to designate more precisely the amount of useful thermal energy from any one reaction, thereby eliminating prevalent empirical considerations. This method of dealing with the subject of burning fuels and heating in general, in the absence of conventional definitions and sufficient experimental data to quantitatively confirm the law, lies naturally in the domain of a more technical treatment. For the purpose at hand we shall be compelled to adhere to existing methods and units, except for having at our command a more comprehensive conception of the actions that take place, which is a material aid in arriving at practical results.

Profiting by the foregoing considerations, and recognizing that the structure of coal chemically and physically is a variable one, the all-important requisite for powdered coal is to render its nature as uniform as possible with reference to a given standard, such that for any given furnace, the temperature and operating conditions at the hearth, shall be maintained as constant as possible with the various kinds of commercial coals, and afford approximately the same regulating qualities.

Assuming a continuous production of powder of uniform fineness and impurities, the inherent weakness of coal for burning in powder form is its deflagrability, which varies as its structure varies. Consistently with the behavior of all solid materials, it is possible to alter the structure of all coals pyrometrically, so they acquire sufficiently uniform texture before combustion to practically satisfy the requirements. In general, hard and high ash coals should be heated to higher temperature than soft and low ash coals; the coking point of the particular coal being the limit.

By rendering all grades of coal equally deflagrable, the precision of other requirements becomes apparent; (a) the velocity of the fuel mixture feed is limited and fixed by the velocity of the flame propagation; this means constant pressure and supply of air for all grades of coals, measurable by the actual amount of combustible content; (b) wider regulation by direct fuel control is possible; (c) very steady and lower hearth temperatures can be secured. The desirability of these conditions is obvious. In general, for constant results, the more inflammable the fuel mixture the higher the velocity of discharge and the lower the temperature of the hearth; conversely, the less inflammable the fuel mixture the lower the velocity of discharge and the higher the temperature of the combustion hearth, necessary to burn the same amount of fuel in a given space. For the realization of these conditions it is assumed that the distribution of combustible charge in the hearth is the same in each case.

The proper velocity of fuel mixture as determined by its inflammability can only be found by trial, and the condition to be fulfilled is that the base of the flame shall approach the outlet as close as possible. A lower velocity may result in back fire within the feed tubes which are of appreciable dimensions and might cause a more or less destructive explosion. A higher velocity carries the mixture far into the hearth before combustion begins, and has the effect of coking and condensing the powder, which drops to the bottom of the hearth in the form of relatively large globules, thereby causing faulty combustion and loss of fuel. Coking of the combustible charge is very perceptible in connection with discharge outlets of large diameter such as are used in cement kilns. The action in this case has been attributed to more rapid combustion on the surface of the combustible jet which has the effect of baking the core within. This difficulty has been overcome by using outlets in the form of a slot of the required cross-section, thereby exposing larger surface to the hot gases in the hearth.

The volume of flames, that is, the zone of oxidation, in general, cannot be predetermined on account of the many uncontrollable variables, especially because the virtual temperature of combustion cannot be ascertained by present means and the real time element of complete oxidation is not definitely known. Observation and analysis reveals that, under similar conditions, more inflammable fuels burn with a shorter flame than the less inflammable. In connection with powdered coal the problem becomes more complex on account of the amount of surplus air necessary for its combustion, which is a variable one. The values variously suggested hitherto vary widely and are so conflicting as to preclude their use. Nevertheless, based on the average temperatures of combustion and the amount and temperature of the gases required, it is possible to arrive at a very satisfactory conclusion regarding the dimensions for the combustion and gas space required.

Briefly, though the combustion of powdered coal possesses a wide margin for regulation by judiciously applying the conditions herein indicated, until more complete experimental data is gathered, it is necessary to consider every element entering, from the nature of the coal to the performance of the boiler, eliminating all precedent existing in burning lump coal, to secure satisfactory results with the powdered fuel.

(To be concluded in February number)

A Forced Steam Circulation and Closed Loop Boiler Feed System for Paper Mills

By GEORGE HOFSTETTER, JR.

PAPER manufacturers have experienced considerable difficulty in removing water and air from their dryers which prevents the circulation of steam through the dryers and causes uneven drying.

This subject has been given considerable study and a new system has been developed by the Farnsworth Company of Conshohocken, Penn., which overcomes the difficulty and has many advantages claimed by the inventor.

A high steam velocity through the dryers is effected by the Forced Steam Circulation System which eliminates all water and air and provides a constant, even, known temperature throughout the dryers at all times, which decreases the pressure necessary to dry the paper and permits the speeding up of the machines so as to increase production anywhere from 5 to 10 per cent.

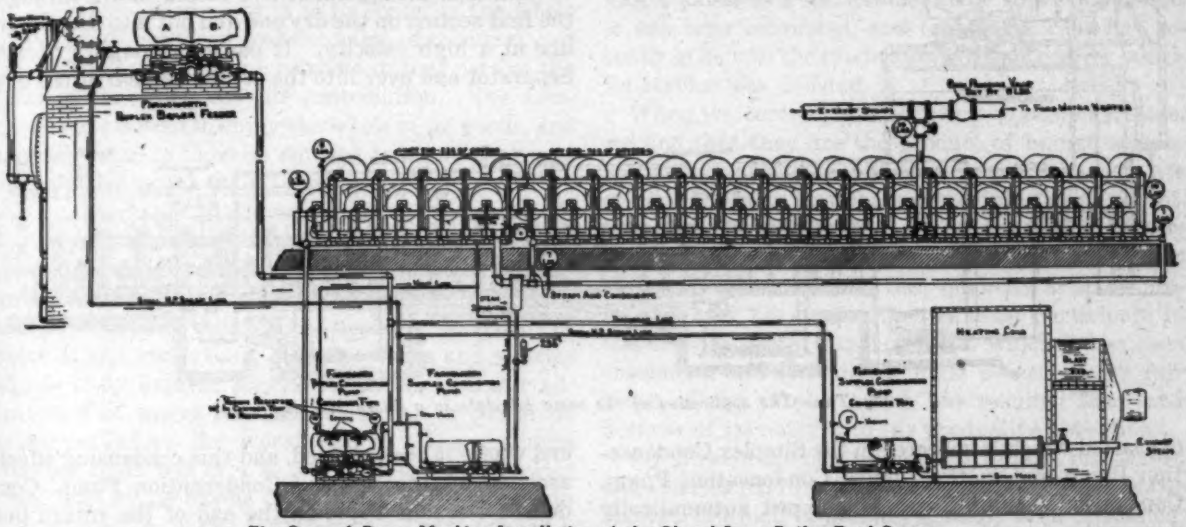


Fig. One—A Paper Machine Installation of the Closed Loop Boiler Feed System

By means of a Closed Loop Boiler Feeding System the condensation from the paper machine and all other heating apparatus and make-up water as well is held under pressure and returned directly into the boilers at a high temperature, thereby saving anywhere from 10 to 30 per cent of the coal. These systems eliminate individual traps on the dryers, Vacuum Pumps, Receiving Tanks, Hot Wells, Boiler Feed Pumps, much piping and maintenance cost.

Figure 1 shows the systems applied to a paper machine having a basement underneath it. This system is explained as follows:

The Paper Machine is divided into two sections, one of these sections to have 75 per cent of the dryers and the other section the remaining 25 per cent. The steam and return headers between the two sections are cut, and a Steam Separator is placed on the end of the return header for the dry end section which separates the condensation from the steam which has blown out into this portion of the return header. This steam is passed over to supply the steam header for the remaining dryers on the wet end. On the end of the return header for the wet end dryers is placed a Duplex Condensation Pump, Condenser Vacuum Type. This machine has cold water sprays in the top of the tank. The spray water condenses the vapors in the return line producing a Forced Steam Circulation.

In other words exhaust steam enters the dry end of the paper machine and passes through the dryers on the dry end at a high velocity due to the condensing of the steam in the wet end section assisted by the vacuum produced by the condensing sprays in the duplex condensation pump on the end of the return line for the wet end section. This also produces a high velocity of steam through the wet end section with the result that water and air is eliminated from both sections and a constant, even, known temperature at all times is produced.

The dryers on the dry end are hottest with a gradual decrease in temperature as the wet end is approached.

If for any reason insufficient steam should pass through the Steam Separator to maintain the re-

quired pressure in the wet end section steam is bypassed through a reducing valve and the proper amount is supplied.

Summing up, therefore, the steam supply line for the paper machine is connected at or near the beginning of the dry end. Steam is allowed to blow through all the dryers in the dry end section and out into the return line carrying with it all the water and air in these dryers. These dryers are, therefore, nothing more than the steam supply line for the dryers on the wet end.

The condensation is then separated from the steam that has blown through, and this steam is passed over to supply the dryers on the wet end section. The condensation that collects in the Separator is drained into a Simplex Condensation Pump. The air which enters the receiving chamber of each machine escapes through the vent.

In the closed loop boiler feeding system the condensation which is collected in the Simplex Condensation Pump and in the Duplex Condensation Pump, Condenser Vacuum Type, is pumped automatically during the operation of the machine to the receiving chamber of the Duplex Boiler Feeder located from 3 to 10 feet above the high water line of the boilers.

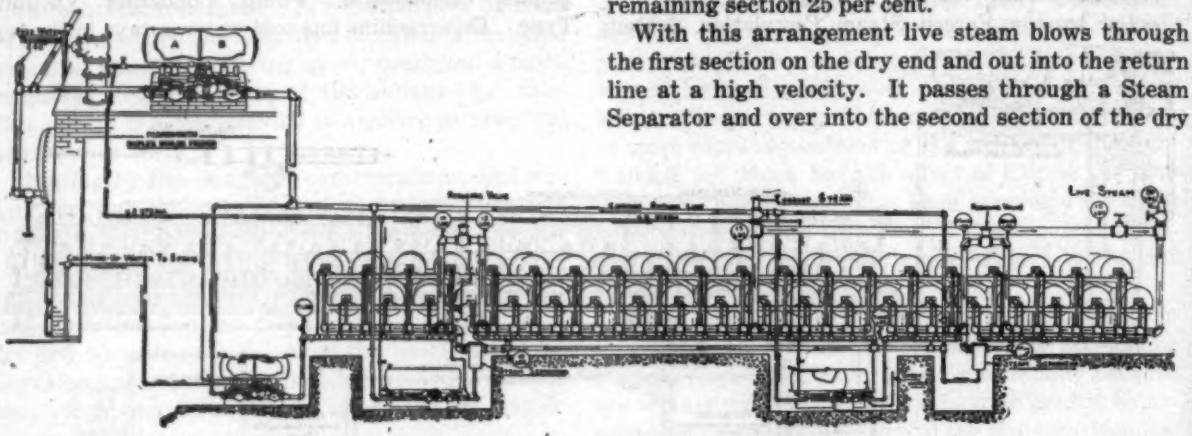


Fig. Two—The application of the same principle to a Board Machine

The Duplex Boiler Feeder has two chambers—one of which is always receiving while the other is delivering the condensation with all its latent heat directly into the boilers giving a high feed water temperature and saving anywhere from 10 to 30 per cent of the coal. The Duplex Boiler Feeder and the Condensation Pumps require only one-tenth to one-fourth the amount of steam used by the common pump because in these machines steam is applied directly in the surface of the water instead of behind a piston.

The condensation from all high pressure traps is discharged directly into the line leading to the receiving chamber of the Duplex Boiler Feeder. The condensation from all low pressure heating systems, Fan Coils, etc., is drained into Simplex or Duplex Condensation Pumps and is forced up to the receiving chamber of the Duplex Boiler Feeder by the application of live steam on the surface of the condensate in the tank while it is in the receiving position.

The Closed Loop Boiler Feeding system is the most efficient method for handling condensation because the pressure is never relieved from the surface which would lower the temperature to correspond with the decreased pressure.

Figure 2 shows the systems applied to a board mill using live steam in the dry end containing one-third of the total number of dryers; the remainder of the dryers are supplied with exhaust steam. In this case the machines which drain the paper machine are set in pits, there being no basement underneath the paper machine.

Under these conditions the live steam division of the paper machine and the exhaust steam division are each divided as in the case of Figure 1. That is to say, each division is subdivided into two sections, one section to have 75 per cent of the dryers, and the remaining section 25 per cent.

With this arrangement live steam blows through the first section on the dry end and out into the return line at a high velocity. It passes through a Steam Separator and over into the second section of the dry end where it is condensed, and this condensing effect, assisted by the Simplex Condensation Pump, Condenser Vacuum Type, on the end of the return line produces a Forced Steam Circulation System through both sections.

The exhaust steam division of this paper machine is handled exactly as described for Figure 1.

The dryers on the dry end are hottest with a gradual decrease in temperature as the wet end is approached. The hot dryers on the dry end set the paper as it leaves the paper machine. The condensation which is drained into the Separator on the live steam dryers is forced to the receiving chamber of the Duplex Boiler Feeder by the pressure carried on the dryers.

The other three machines pump the condensate to the receiving chamber of the Duplex Boiler Feeder, and, as previously stated, all the condensation with its valuable heat units is delivered directly into the boilers.

These new Systems have such wonderful possibilities that they are well worth careful consideration by the engineering profession.

The Determination of True Values

By LOUIS VON HASSLACHER

IN THE development of this theme, consideration will be given separately to each of three aspects which it presents.

1. What are true values?
2. Why should they be determined?
3. How may they be determined?

One—

(a) True value is the measure of the extent to which efficient human service on the one hand, and the efficient service of capital on the other, have entered into economic goods. To the extent that service fails to attain normal efficiency, value will fail of being true.

Human service is, of course, the force out of which all production springs. The value of the service of the whole community is to be found in the whole of the goods produced, and the value of the service of the individual, therefore, consists in that part of the total goods which are his contribution. The community is entitled to enjoy the whole of its goods, and the individual is likewise entitled to enjoy that part of the whole which he has contributed.

Now, the value of human service is commonly, although not accurately expressed in wages and salaries. Unskilled, semi-skilled, and skilled labor; the vocations of business, and the professions, etc.; each and all have their more or less nebulous standards of value at any given time. Ideally, wages and salaries should truly express service value, and the fair adjustment of wages and salaries is one of the great problems before the world today. It is doubtful whether there will ever be a true measure of service value, and by no means certain that in the long run they should be, in the strict sense. There is such a thing as a minimum wage, and if that means anything, it means that the lowest grade of human service, assuming it to be necessary to the welfare of society at large, is worthy of no less a reward than shall guarantee, or at least make possible a decent, self-respecting standard of living, which shall include the satisfaction of every reasonable and proper need and desire. If it be true that the lowest grade of human service is capable by itself of producing only the meanest of housing, of appareling, and of provending, it is equally true that the highest grade of human service is capable of producing directly or indirectly in such magnitude that were the division of goods based literally, such individuals could and would receive rewards in goods far beyond their power ever to consume or enjoy. In the division of goods the capable must share their surplus with the less fortunate, and the rating of service values must, and will be effected in this spirit.

Value then, is first, human service as expressed in prevailing wage and salary levels.

(b) Economic goods are not produced by direct human service alone. There enters the factor of capital service. Were there no capital involved, the distribution of goods would be decided through a consideration of the individual's contribution to the common fund of goods, or each would draw the equivalent of his own particular contribution. Capital service consists first in the sum which is required for the production of any given lot of goods, and in the time for which it is continuously employed in such service. But capital is also consumed in the production of goods. Capital assets have a limited life. When the end of that life is reached, and the asset no longer exists as a serviceable factor, it is evident that it has been consumed, and that further, it has actually gone into the production of the goods for which its service was enlisted.

When we contemplate economic goods, therefore, we find that they are the product of human service and of capital service, and that further, the very life of capital assets also has entered into them. It follows that in the division of goods, capital rightly participates, and the individual may no longer draw out of the common fund that quantity actually produced under his hand. Capital must participate in the division first, to the extent to which it has been consumed, and secondly, it must be accorded a fair share of the surplus which has resulted from and because of its entry into the productive operation.

(c) To sum up, true value is the total of just wages and salaries paid for efficient human service, plus the amount in which capital has actually been consumed, plus a just return for the efficient service of capital as measured both in amount and the time for which such capital has remained in service.

Two—

(a) The production of economic goods and their fair distribution are the basis of human well being. To the extent that production increases; to the extent that there IS a fair distribution of goods; to the extent, in a word, that the needs and reasonable desires of mankind may be satisfied—to that extent, at least, will men be made happier.

Production is a matter of human service. What total volume of goods may ultimately be enjoyable, assuming natural resources to be adequate, is a matter of efficiency—of industry and ability. It is clear that no more goods may be enjoyed than are produced. Efficiency as a factor of service, both individual and collective, is vital in its bearing on human

well being, but we are concerned here rather in the distribution or division of goods.

(b) The individual is entitled to enjoy goods to an extent consistent with the value of his service. If the enjoyment of goods were direct, each would proceed to the enjoyment of what he had individually produced, and that would be the end of the matter. But enjoyment of goods is not direct. Between production and enjoyment lies the whole complex of exchange, with its attendant train of wages, values, prices, etc. Out of this complex have arisen most of the inequalities which on the one hand are manifested in inordinate possession, and on the other in insufficient for proper standards of living.

(c) The division of goods is affected largely by price, and a fair division is dependent chiefly upon just pricing. The sound basis of price is true value. Therefore, the determination of true values conduces directly to the just and equitable distribution of goods. It is and must be concerned equally in justice for the worker, for the enterpreneur, and for the owner of capital.

(d) Viewed in this light, the determination of true values has a profounder purpose and destiny than is revealed under any superficial consideration, and it becomes evident that sound cost theory and efficient cost practice are entitled to a place in affairs not less than as a major function. The ultimate division of goods upon a basis of strict justice to all concerned may only be accomplished through an enlightened recognition of the fundamentals of service, out of which such goods have sprung, and to pursue this as an objective with any and every means within reach, is wisdom economically, morally, practically, and even in the traditional sense of good business.

(e) In our industrial scheme, the direct enjoyment of goods has been removed from men, and they are separated from that enjoyment by the barrier of exchange with all that it means, and it is because of the fact that wages and salaries are not always justly founded in the true sense, and that prices have not always the basis of true value, that the division of goods to a very great extent, is without equity. The determination of true values first, and the basing of prices on their sure foundation will go far toward bringing about that just distribution of goods, upon which human well being itself, in the material sense, absolutely depends.

Three—

(a) The terms "Human Service" and "Service of Capital" may now be translated into those more practical terms which are familiar to us in our cost work. I will set them up in the following form:

1. Materials.
2. Service expended upon materials as such.
3. Manufacturing service.
4. Warehousing and delivery service; shipping, cartage, etc.
5. General administrative and selling service.
6. Capital service.

(b) Material which in itself embodies all the services enumerated above, should be charged at the purchase price, to which should be added any general transport costs not already included.

(c) The service expended upon material as such consists of purchasing, local transport and storage. These expenses should be assembled under and applied through a standard rate per hundred pounds. This is a convenient and logical method of distribution. Material expense accounts should be opened with the accrued charges, at the standard rate upon materials on hand at a given time. Thereafter these accounts should be credited with the expense at the standard rate upon material actually withdrawn from stock and passed into production, and charged with actual costs. The loss or gain will disclose the efficiency of operation, of the standard rate, or of both.

(d) Manufacturing service consists of all labor which may be directly or indirectly allocated to any manufacturing operation, together with such purchased supplies as are used incident to such operation. I purposely omit reference here to other and secondary elements of manufacturing cost for the reason that the two already given are fundamental, and all others exist only in various combinations of these two. These costs should be assembled under and applied through a standard machine rate. Operating accounts created for the purpose, and carried out to any degree of refinement deemed desirable, should be credited at the standard rate or rates, charged with actual costs. It is desirable in the case of repairs and certain other items that reserves be created to equalize the charges to operating accounts. Here again the efficiency of both operation and standard rates will be disclosed in loss or gain.

(e) Warehousing, shipping, cartage, are terms which need no explanation. The cost of these services should be assembled under and applied through a rate per hundred pounds, which is both convenient and logical, and the same further comments apply here as in previous paragraphs.

(f) General Administrative and Selling Service should include only those expenses which remain after the segregation of every item which may properly be applied direct to any operating account. Of all methods of distributing this expense, that one which has for its basis the manufacturing service value is certainly the most convenient, and while it is, like any other method of distribution, open to criticism, it is still defensable from a theoretical standpoint. It rests in the conception that administrative time and attention are attracted to and required by operations roughly in proportion to their service value. Where a separate and specific treatment of any particular item of expense is clearly desirable, it should certainly be made—as for example in the

case of selling commissions paid as a percentage of sales.

(g) There remains only the service of capital to consider. The capital employed in any industrial operation is invariably found to exist in two distinct forms, each having separate and strongly marked characteristics. There is first that part which is in the form of fixed assets; real estate, machinery and equipment; and secondly, that part which is in the form of inventories, cash, accounts receivable, etc., etc., and which is commonly termed working capital. I have said that true value is in part the measure of the extent to which the service of capital enters into the production of goods, and I have defined that service as the amount in which, and the time for which capital is employed in the interest of any particular operation. A great deal is said about a fair return upon capital. I must confess that I do not know what a fair return on capital may be. But I suspect that in the long run, the return allowable to capital will be something relatively small. There is no inherent efficiency in capital, and efficiency comes only in the use of it, or in other words, through the introduction of human service. It is certain that rates of return on capital vary in different classes of enterprise, and it would seem as though the rate is uniformly low in those cases where fixed assets preponderate, and uniformly high where the preponderance is of working capital. The characteristic difference is that in the use of working capital the element of turn-over comes in to a marked extent, whereas in the case of fixed assets the turn-over is reduced in some cases almost to the vanishing point. Whether or not the greater return in the one case is the mere result of turn-over, or whether it may be due to the fact that in general the element of risk is less where there is a preponderance of fixed assets, is worthy of careful study. I do not wish to attempt to prescribe any rate of return.

(h) The service of capital in the case of fixed assets of whatever class, is to be expressed, and its value incorporated into final total values through the inclusion of a given rate in operating cost. Thus the value of capital service through the use of real estate is taken up in rental charges. The resultant sums are credited into interest reserves and charged to real estate operating accounts. Likewise the value of capital service through the use of machinery and equipment is taken up through proper charges made to the various operating accounts, and corresponding credits to an interest reserve. It is to be noted that the inclusion of these interest charges in cost does not mean that they are so included as elements of cost, but that such treatment constitutes a definite provision for the return for the service of capital.

(i) Depreciation on all classes of fixed assets subject to such a charge, is taken up in the same manner. Rates should be specifically fixed upon each general class of assets, and preferably applied upon constant and not on diminishing values.

(j) It follows that in the ultimately expressed total value, or to put it more concretely, in the final selling cost, there are included such charges as shall represent the exact extent in which fixed capital has served, both with respect to the sum and the time for which such sum has remained continuously in service in the interest of any given operation.

(k) The value of working capital service is determinable through a consideration first of the amount of such capital required in each instance, and, secondly, of the time for which it will remain in service. The total selling cost of any given lot of goods represents in effect the amount of working capital required for the production of such goods, and the period of investment is the sum of the process period plus the warehouse period, if any, plus the normal period for the collection of the bill, plus a provision for a normal cash reserve, and plus also a supplementary normal period for material value alone in those cases where balances of material are regularly maintained in stores. This latter is in contradistinction to conditions of production where materials are especially made, and where they enter into process before, or not later than the time they actually begin to represent working capital.

(l) The financial result of any industrial operation is expressed under prevailing custom in terms of net earnings on capital employed. Custom has also countenanced certain standards whereby this result is measured, and we appraise the success of an enterprise in the financial sense, by the proportion of its net earnings to its capital. The traditional method of providing for profits by the addition of wholly arbitrary percentages to cost is inadequate. Such profits considered by themselves may be dangerously misleading. Certain gains that appear to be entirely satisfactory when considered in relation to cost along shrink to unsatisfactory proportions when measured against the capital employed in securing them. On the other hand, there are many classes of industrial operation where small profits as related to cost afford highly satisfactory returns upon the money invested.

(m) Since profits are the chief aim of business enterprise, and since further they are subject to final expression and rating as net earnings on capital, it is clear that the treatment of profits on each individual transaction must be accorded with a full consciousness and a clear understanding of the degree to which the employment of capital in any form will be involved, and the time for which it will be continuously required.

(n) Provision for profits when made in conformity with this principle, assuming the rate itself to be fair and just, will secure to capital in the final division of goods that share which will truly express the value of its own contribution.

Storing Coal or Similar Material by Means of Scoop Conveyors

By F. J. McMAHON

AN interesting application of scoop conveyors for storing coal is shown in the photo Fig. 1, illustrating five machines being used to unload coal from hopper bottom cars direct to storage pile. Four of these machines are 12″ wide by 24′ long, the other one being 12″ by 20′. Each is equipped with its own electric motor and can be operated singly if desired.

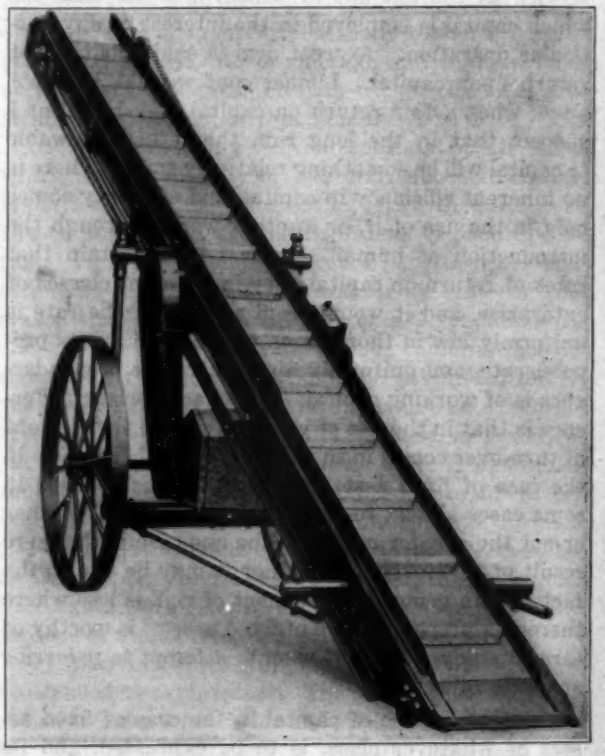
These machines provide a convenient, efficient and

One—Unloading coal a distance of 150 feet with Five Scoop Conveyors

flexible arrangement. The first machine is practically self-feeding from the hopper doors of the car and the other four may be swung around at any angle

Three—Loading Coal Hopper on a Hunt Electric Storage Battery Truck with a Scoop Conveyor

to cover a wide storage area. Five machines arranged in this manner can be operated by one or two men. They can also be used to convey the coal direct from storage pile into boiler room. Figure 2 show four machines being employed in this manner. Where



Four—Scoop Conveyor fitted with Low-Cleat Belt

desired, one machine can be used to load an electric storage battery truck to convey the coal directly into the boiler room as shown in Fig. 3.

The advantages of using several 20′ or 24′ long

(Continued on Page 882)

Two—Using Four Scoop Conveyors to carry coal from Storage Pile to Boiler Room

How Right Ventilation Affects the Paper Industry

By C. A. EDDY

MANY of us unthinkingly do not give the credit to the importance of paper in the industrial world which it deserves. There is hardly a move we make without depending upon paper in some shape or form. In our business life we could not go very far without our documents which make business transactions legal and necessary.

Probably at no time in the world's history has paper been depended upon to such a great extent as it is today. We Americans are omnivorous readers, which means tons and tons and thousands of tons of paper to be manufactured for our books and periodicals. American business is the best advertised on earth, which means many more tons of paper must be used to carry the advertising message to the millions of readers of periodicals and to other millions of buyers thru direct methods and other plans which are now feasible and profitable.

After the war conditions have made possible a volume of advertising heretofore unthought of. Concerns whose last thought has heretofore been publicity are now blossoming out as large advertisers, which in turn means an unusual demand for paper to meet the needs. Wherever you go you will find the uses and needs for paper greater now than ever, which in turn means that the industry has jumped tremendously in importance in the last few years.

To meet these new conditions, the paper manufacturers and the mill man must necessarily do some pretty hard thinking and planning. Not alone must they meet the unusual demand for paper, but they must cope with new conditions in their mills. Just as the war made a big change in our methods of using paper, just so has the war affected mill conditions, especially the labor end.

These things must all be taken into consideration when we talk about ventilation in the paper mill because ventilation is one of the big important factors to the successful conduct of the paper mill. This is especially true in connection with the help problem because so many men who were satisfied with any kind of working conditions furnished them before the war, because of their taste for a different life, are now demanding new working conditions and these demands must be satisfied.

The men who served in camp or lived in outdoor France for a year or more are not going to be satisfied to come back to the stuffy, poorly ventilated factory or office. They will not be satisfied to work under unhealthy conditions because their eyes have been opened to the value of fresh air every hour of the working day and they are insisting on these conditions being maintained in the mill in which they work. The only method which will satisfy such men is the furnishing of a quantity of clear, pure air in every nook and corner of the mill. If these conditions are not maintained in one plant, workers will go to others because they now feel that it is their right to insist upon healthful conditions at least.

When you stop to give this question any thought you will probably realize that as far as such insistence on their part is concerned, they are perfectly right, because a man to do his best work needs healthful surroundings, and first of all comes fresh air. Not alone that, but by maintaining the right temperature in the plant a higher quality of product is insured.

Many mill superintendents in giving this question thought, bring out the point of increased expense for the installation of the right kind of ventilating equipment. They lose sight of the fact that there are two factors to be considered—first, the better health of the employes, and, second, a better quality of product—which in turn means greater profits for the mill. This is a fact which should not be overlooked and it is a big point in paper making today.

Another factor is economy of operation. In the paper mill a great deal of steam is used making a fog so thick that workmen many times cannot see more than a foot or two, and giving them working conditions approximating those of a turkish bath. In such instances, the ventilation is of extreme importance. The most important factor in determining the amount of air to be supplied in a machine room is the amount of moisture present. From a large mill several tons of moisture are thrown off daily which, if it is not removed, will condense upon coming in contact with the cold roof and skylight surfaces and fall back upon the material in the machines, often causing serious damage. It is a well-known fact that the amount of moisture air will contain increases very rapidly with the temperature so that by supplying sufficient air at the proper temperature, this moisture is carried away thru the vent stacks before it has had opportunity of condensing.

The amount of paper spoiled or rendered unsalable as high quality stock and the profit lost in the mill in which the proper ventilating system has not been installed would more than pay for the very highest type of ventilating equipment thruout plant.

As an instance of how these things work out, take

the case of the superintendent of a prominent Michigan mill. Before the war he had had little difficulty in getting all the competent help needed. His people were satisfied with moderate wages and with the conditions as they then existed in that particular plant. His business was noted for the high quality of its enamel paper and was pointed to as one of the model mills of the paper industry. During the war with its changed conditions, this particular superintendent found that he had to reckon from an entirely different viewpoint. He found help hard to keep. His product was not as satisfactory as it had formerly been. Complaints were coming from all sources—from workmen and buyers. He found that the old order would not do and that he would have to make some radical changes if the mill was to continue to show a profit.

After going out among the workers he found one reason why he could not keep high grade workers was because they were not satisfied to work in the steamy, clammy, moisture-laden atmosphere of the mill. It was too easy to get work in other plants paying them as much money even if they were not working at their trade. Investigations showed him that he would have to make the necessary changes in his mill in order to keep the only average help which he was now able to get.

A high grade ventilating system was installed to carry away the steam and moisture. Fresh air was supplied to all parts of the mill with a tremendous change in the atmosphere and general working conditions.

The result was almost immediate. Workmen became more satisfied. Less difficulty was had in handling the stock. He also found that due to the great demand for his paper it was necessary for him to find a method for more quickly seasoning the paper, and here it was that right ventilation came to his aid, and he was enabled thru the installation of the proper ventilating equipment to insure control of temperature and humidity independent of weather conditions outside the plant.

Aside from the factors mentioned above, proper ventilation is used in departments where rags are sorted and dressed and then mechanically dusted. In the rooms where bleaching, boiling and the washing processes are subjected to chemicals, foreign matters and high temperatures, conditions have been made almost ideal thru the proper use of ventilating equipment.

One of the big points to be considered in connection with the ventilation of the paper mill is the uniformity of stock. Probably there is no one point where improvement has been noticed to a greater extent than in the ability of the paper man with the right kind of ventilating equipment to turn out uniform stock and to be independent of weather conditions. Furthermore, in these days of high pressure methods, stock seasoning is important and ventilation plays a big part by enabling the mill superintendent to cut down on the time necessary to season the stock.

Those who follow current events and publications of today realize the great stress being laid on air conditioning and proper ventilation. Every industry is affected because the human element plays such a big part in labor today that plans and methods and ideas which can be worked out to proper working conditions should by all means be adopted. The importance given to the subject of ventilation shows how necessary and vital it is to every industry. This is particularly true as applied to the paper mill, and the mill superintendent who fails to realize this is overlooking a big opportunity for securing and holding a better class of workmen or turning out a higher quality product which in turn means better profits.

In the manufacture of paper of all kinds, pulp board, roofing, belt, etc., large quantities of water are evaporated and in order to keep the buildings dry it is necessary to use fan apparatus to introduce hot air to absorb the evaporated water.

In some cases, steam pipes of small diameter are closely spaced along the roofs of paper mills to keep them dry, but this is not very effective as, altho the roofs are protected from the deterioration which rapidly takes place when they are allowed to remain in a wet condition, the moisture is not effectively removed and in consequence the walls of such buildings are usually in a wet condition, the window frames rot out and the machinery depreciates rapidly due to remaining in a wet condition.

In these days of the high costs of material and the scarcity of labor, rapid deterioration of machinery and buildings must be considered in connection with proper ventilation and here is another point where it is good business to keep equipment up to standard by the most economical methods, and one of these is the use of proper ventilation.

Water is evaporated in beater, jordan and machine room, but of course to the greatest extent in the last mentioned rooms, where a tremendous amount of moisture is given off. Paper machines of the Fourdrinier type consist of 20 to 80 or more rolls, arranged 2, 3 or 4 decks high, and thru these steam heated rolls the paper passes from the wet to the dry end, giving off moisture in transit. These machines require 1 HP. per foot of paper, speed per minute for 130 to 145 inches width of pulp board.

Paper or pulp board usually enters a machine with moisture content of about 60% and leaves containing about 5%. If dried beyond this point, cracking is produced, as the material becomes too brittle. Pulp goes to a machine with a moisture content of very nearly 100%, but after passing the last press rolls the water is reduced to about 60%, and from this amount down to the final 5% the evaporation is produced by the steam heated rolls and by hot air de-

(*Continued on Page* 870)

Boiler Horse Power Saved by a Feed Water Heater

By W. F. SCHAPHORST, M. E.

THE feed water heater is a device that is not appreciated enough. Some men seem to have the idea that such heaters are "made to sell" mostly, that they are a "theoretical" addition to the plant rather than a practical addition. The statement is made in advertisements, "A feed water heater will save from 10 to 25 per cent of your coal" and the reader or prospective buyer immediately adds his grain of salt.

In order to set these doubting Thomases aright I have therefore developed this chart. Simply lay a straightedge across the chart and column B immediately gives the boiler horse power saved by a feed water heater.

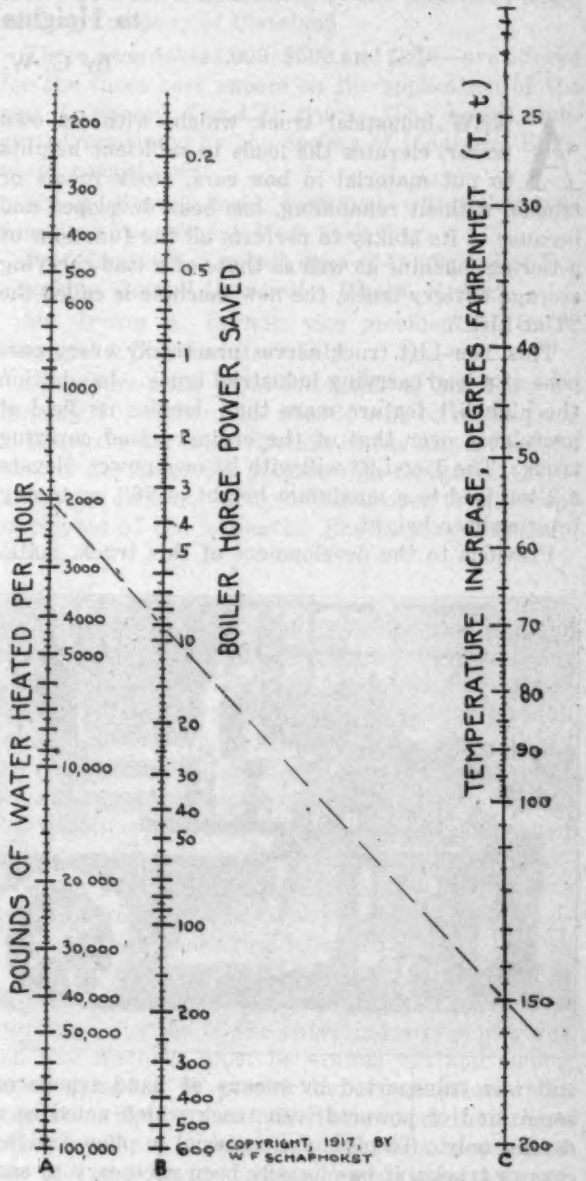
For example, if you use 2,000 pounds of water per hour and if a feedwater heater will increase the temperature of the feed 150 degrees F., how many boiler horse power will the heater save/

Connect the 2,000 (column A) with the 150 (column C) and column B shows the saving to be 9 boiler horse power, as indicated by the dotted lines drawn across this chart.

In other words, the feed water heater virtually gives you nine boiler horse power for nothing. It utilizes the steam that would otherwise go to waste. Or, if your present boiler is a 60 h. p. unit, and if you add the above heater, you can then get 69 h. p. out of the boiler without burning any more coal. Doesn't that seem worth while? It is worth while.

Besides, this chart does not show the additional saving due to keeping scale out of the boiler, which often amounts to 25 per cent in itself. That, also, should be considered.

The range of this chart, it will be noted, is great enough to handle the conditions in any ordinary small or large power plant. Six hundred h. p. saved is the maximum.



Truck to Save Space, Time, and Man Power

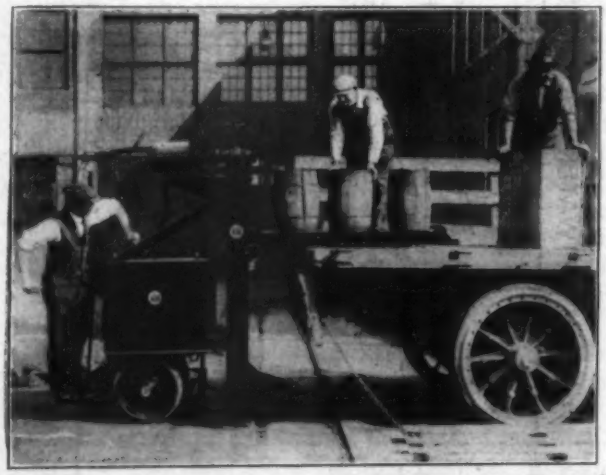
Machine Automatically Picks Up and Carries Load to Destination, Elevating Material to Heights Over 6 Feet

By C. W. GARRISON

A NEW industrial truck which, with its own power, elevates the loads to sufficient heights to put material in box cars, stock rooms or trucks, without rehandling, has been developed and because of its ability to perform all the functions of a tiering machine as well as those of a load-carrying storage battery truck, the new machine is called the "Tier-Lift."

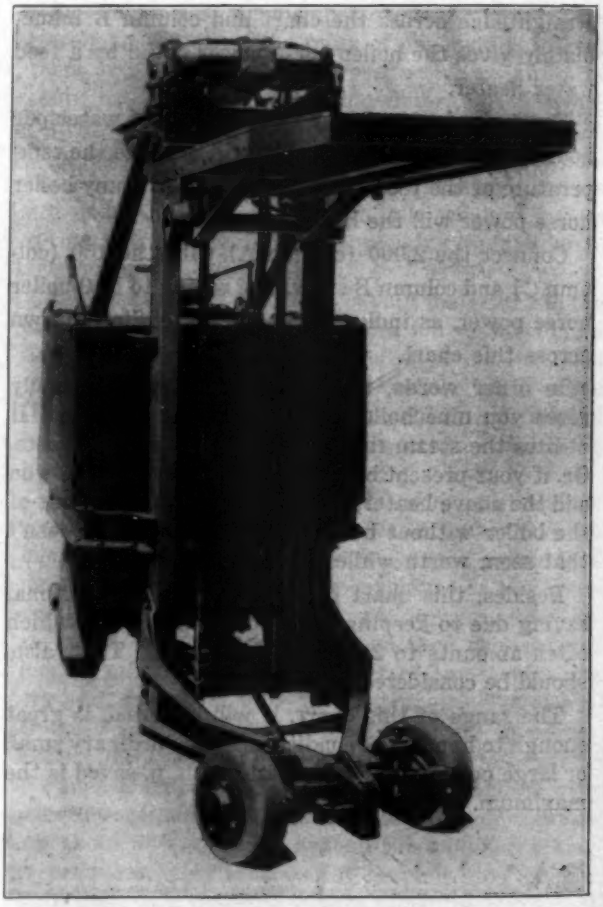
This Tier-Lift truck serves practically every purpose of a load carrying industrial truck. In addition the high lift feature more than doubles its field of usefulness over that of the ordinary load carrying truck. The Tier-Lift will,with its own power, elevate a 2-ton load to a maximum height of 76", or to any intermediate height.

Previous to the development of this truck, material was transported by means of hand trucks or some kind of power driven truck which acted as a carrier only. To place the material in piles, freight cars or trucks, it has usually been necessary to employ men to elevate the loads. In some places where cranes were available, they could be used for this work. Even then, however, a number of men were needed to handle the material.



By reason of its high lift, releases the crane from this work, it gives a more flexible system and reduces the waste of man power to a minimum.

The economical height to which material can be piled is greatly increased and the storage capacity of a given floor space doubled or tripled by this new high lifting feature. Storing material on skids so that rehandling of material in the storeroom is entirely eliminated is made practical. Where the material is such that it can bear the weight of loads above, the loaded platforms can be piled on top of each other. Labor cost is thus reduced to a minimum, material can be handled more quickly and storage of the floor space is increased 200% or more.



This makes possible a new method of storing which permits the selection of loads from specially designed racks. With the arrangement shown, any loaded

platform in the racks may be removed without disturbing the other loads, thus giving a flexibility in the storeroom. This time saving feature added to the reduction in cost of handling material, quickly repays the investment in the equipment. It is also well adapted to operation in crowded spaces because of its short turn features.

The drive used in the Tier-Lift is the same drive that has been used on Lakewood tractors and trucks for over eight years. Its efficiency is proved by the fact that on the first machines built this same drive is today giving satisfactory service.

The 4-wheel steer permits turning in a circle 92" in radius. This permits easy turning innarrow aisles, or congested parts of the plant, and gives easy entrance into box cars.

There are three speeds forward and three speeds reverse. The controller handle is conveniently located for operation for travel in either direction. The lifting mechanism is operated by means of a specially designed controller with one speed in either direction. The lifting is done by means of high efficiency steel worm screws. A separate motor is used to raise the load.

The load platform is carried by a cantilever type support and the load is balanced over the load carrying wheels. Ball bearings are used throughout and by a special Lakewood design the friction losses in elevating and lowering the load platform are practically eliminated.

As an inducement to industrial plant managers, engineers and others to study their inter-department transportation problems and more fully realize how industrial tractors and trucks help to conserve labor and increase production, an offer of three awards for the three best analyses of the application of this new Tier-Lift truck is announced by the Lakewood Engineering Company of Cleveland.

Three awards—$1,000, $500 and $250—are offered for the three best papers on the application of the new Lakewood Tier-Lift truck. The award committee, appointed by the Society of Industrial Engineers, consists of:

Mr. A. Russell Bond, chairman, editor Scientific American Supplement, New York City.

Prof. Dexter S. Kimball, dean of the School of Engineering, Cornell University, Ithaca, N. Y.

Mr. Irving A. Berndt, vice president of C. E. Knoeppel & Co., New York City.

All papers must be in the hands of Mr. Bond by January 30, 1920. The awards will be made prior to February 28, 1920. Details of the contest will be sent by the Lakewood Engineering Company, Cleveland, upon request. The contest is open to all except employees of the Lakewood Engineering Company.

(*Continued from Page* 867)

livered between the rolls when a modern fan system is used.

The amount of air to be delivered between the rolls of paper machines should be figured on the basis of 15 grains of moisture picked up per cubic foot of air. As an example, take a pulp board machine producing 75 tons of dry material per 24 hours. This calls for evaporation of 9,600, or say 10,000, pounds of water per hour, which equals 1,167,000 grains per minute. Allowing 15 grains per cubic foot of air, this calls for 78,000 cubic feet of air per minute.

The air should be delivered to the machine at from 140 to 150 degrees F. If this temperature is exceeded the quality of material tends to be lowered, due to a reduction in strength. The distributing pipes between rolls are usually 6" diameter and the length being about the same as the length of the paper machine rolls. The pipes are run horizontally between the rolls so that about the same number of distributing pipes are needed as there are rolls in any given machine. Air emerges from these pipes thru slots 6" long by ½" wide. These slots are arranged in two rows, end to end, with just a small bridge between each two slots so as to retain the strength of the pipe.

In addition to the air delivered between the rolls of paper machines as mentioned above, a regular distributing system should be arranged, conduct depending upon the locality of the mill as this varies in either northern or southern climates. A great many mills have worked out their plans along the above lines and they find that not only are working conditions much more satisfactory in every respect, but the finished product enables them to charge a better price and to finish the paper much faster and easier. The question of production enters to a great extent in the paper mill, the same as in any other manufacturing plant and the more up-to-date the methods used the greater the opportunity for increased business and the handling of business already secured.

Just as the conditions of today in other lines of business are entirely different from those of a few years ago, just so in the paper industry new plans and new methods must be worked out and among these, none are of greater importance than right ventilation thruout the mill. In a short time there will be few if any paper mills who have not recognized this fact and made changes in equipment to meet the present day conditions. The mill superintendent who does not begin now to revise his estimates of present day needs and make the necessary moves to bring his equipment up to the standard is going to be left far behind by the progressive mill man who is already taking every posible advantage of conditions which will enable him to turn out a better quality of paper with a consequent added profit.

Rope Drives for Beaters

By E. R. LOW

THERE are three methods in use for driving beaters. The oldest type of drive is by means of a belt and is to be found almost exclusively in the older mills. The other two drives, the silent chain and the rope drive have come into use more recently and are to be found in the new and reconstructed paper mills. The belt was used on the older installations on account of the system of driving

Beaters Driven with Rope Drives

the various machines from a main shaft driven from a water wheel or steam engine, and while engineers, especially in England, were familiar with rope drives, the transmission of power to beaters by them was not developed until a comparatively few years ago. The rope drive for this purpose has now passed the experimental stage and with the universal use of the electric motor has become a standard equipment in the beater room.

American and English Systems

There are two systems of rope drives, one known as the continuous or American system and the other the multiple or English. As the names would imply the continuous system is mostly used in this country. This system consists of passing a single rope as many times around the driver and driven sheaves as there are grooves to be filled and carried across the entire width by means of sliding tension sheaves. This system is especially adaptable for turning corners or negotiating any angle, and it has a chief advantage in the equality of tension throughout the drive. The main advantage of the multiple system is that more than one rope seldom breaks at any time and when this happens the remaining ropes can carry the load until a favorable opportunity affords to replace it. If the system is designed correctly and sufficiently strong, however, there will be very little trouble experienced from breaks in the ropes on beater drives and therefore the American system is considered the better.

Manila and Cotton Rope

Although various materials have been used by the rope maker only two have sufficient qualities to make a satisfactory rope for transmission use. In this country Manila has been the more popular, no doubt because it is cheaper. In England the cotton rope has the greater number of advocates. Most authorities favor the cotton because they claim it is more resilient, has greater grip and groove impact and has a much longer life. They also claim that cotton ropes are less susceptible to atmospheric changes and are affected very little by moisture, which of course is a favorable feature in paper mill use. It is further claimed that the harshness of fibres in Manila rope make it impossible to compress them into a solid mass, and the strands therefore rub upon one another with every bend of the rope until the center is reduced to a fine powder. On the other hand the writer has used Manila ropes for driving beaters and has secured very satisfactory results at an extremely low cost.

Meets Various Conditions

The design of a rope drive for beaters must naturally vary somewhat in every mill on account of differences in construction and size of the beater

View of Beater Line Showing Details of Rope Drives Operating Beaters

room as well as the location of equipment already installed. In laying out the drive it is therefore advisable to secure the assistance of experienced

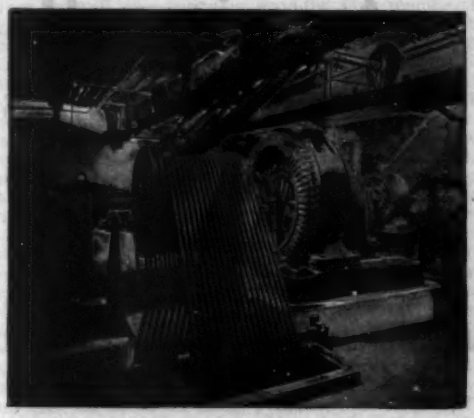
transmission equipment manufacturers most of whom are willing to furnish complete designs and details gratis with a guarantee of efficiency and durability with the hope of supplying their equipment.

Rope Drives Superior to Belt Drives for Beaters

It is generally conceded that the rope drive is superior to a belt and while some engineers continue to favor the belt there is no question that the latter is a thing of the past for driving beaters. The prime feature of rope driving is the groove impact. When the sheaves are correctly grooved this feature permits rope driving to be treated as a positive means of power transmission and no allowances need be made for creep or slip. Groove impact also acts in opposition to centrifugal force, which has proved to be such a handicapping factor in belt driving. Opinions differ on the comparative efficiencies of belt and rope drive, but generally where comparisons are made it will be found that all factors have not been taken into consideration and fair tests will prove the rope to be the better.

View of Horizontal Application of a Rope Drive

In a great many mills the silent chain drive is used for driving beaters and there is no doubt that it is a commendable means of transmission for this purpose due to its efficiency and compactness. In one mill, however, where both rope and chain drives are in use under exactly the same conditions the maintenance cost has been considerably less on the rope drive. It has been found that the chain drive will not last more than two years continuous service and when it wears out it is necessary to replace not only the chain but the sprockets as well. It is readily seen that the constant wearing of the steel links upon the steel sprockets will change the pitch. On another installation where rag stock is used it was found impossible to keep the dust from the drive and the wear was very great with the result that many links were broken. When new links were put in the chain their pitch was different from the old ones and the sprockets. This threw all the strain on the new links which caused them to break down immediately. All methods that were practical were tried to house the drive to eliminate the dust, but the more elaborate the housing the more difficult it was to replace when a chain broke, as of course the breaking chain would tear the housing to pieces. So far as silence is concerned the rope drive excells.



Rope Driven Generator in Paper Mill

In installing rope drives on beaters it is well to use as large a sheave on the beater shaft as is practical. This acts as a fly wheel and its momentum overcomes irregularities in the load. The feature is especially advantageous where lumpy stock is used and where the driving medium is an electric motor.

Proceedings of the American Pulp and Paper Mill Superintendents' Association Meeting on November 6-7, 1919, at the Congress Hotel, Chicago

Friday Morning Session, November 7, 1919, at 10 o'Clock A. M. President Fred C. Boyce, Presiding

(*Continued from January Number*)

Mr. Weatherly: I cannot give the reason exactly without knowing the conditions. Wood blocks will expand slightly under wet conditions and we build a special block for this purpose. Each block has two projections or lugs on one side and one lug on the end. When the blocks expand, the lugs crush in taking care of the expansion and prevent the floor from raising or bulging. Each block carries its own expansion insurance. We are using this block for street work under all sorts of wet conditions.

We can absolutely guarantee to overcome that difficulty. We have worked it out until now we have it perfected and it cannot do that; the blocks will go together but they wi'l not come up.

Dr. Kress: Is it possible to creosote timber in such a way as to absolutely avoid bleeding? Supposing that you make joists out of creosoted wood, would it be possible to absolutely treat the timber of vats as not to contaminate the stock.

Mr. Weatherly: We can take timber and the method of treatment has nothing to do with the kind of oil that you use, the mechanical treatment. We take the timber and put it into the cylinder and after it has thoroughly impregnated we take that and raise the temperature of that cylinder to, say 150 degrees Fahrenheit, higher than any temperature they will be exposed to.

Dr. Kress: This will be cold temperature.

Mr. Weatherly: Here is what we do: We bleed the material in the cylinder; we take the oil out of the cylinder entirely, pump it all out, leaving the material simply there and then we heat those timbers. In other words we bleed the material in the cylinder during the treatment and then we give that material a steam bath which will wash it and again eliminate any creosote coming out of the timber after the material is treated. In other words we give it all the hell in the treatment that it is going to have afterwards so you won't have any trouble after it gets out.

Mr. Barth: By the way, Mr. Weatherly, I wish to make a correction. The character and grade of the creosote has very much to do with the treatment. You can obtain the same dry condition with an empty cell treatment; that is what the word implies. Now it depends on what conditions they should be used under, whether it is severe enough to penetrate an ordinary film of creosote. This is a vat?

Dr. Kress: Yes, sir, a tank.

Mr. Barth: I see. Now an ordinary light treatment will suffice there. If you use, for instance, an open tank process the refined oil that you have got to use in the open tank process will largely eliminate any possibilities of bleeding because you have no evaporation. That is in addition to what Mr. Weatherly explained. It would also depend upon what method of treatment was used.

Mr. Weatherly: I don't want to get into a technical discussion, because it is pretty deep, but I would like to just tell you that it is true that it can be done.

The President: We are from Missouri, though, you know; we like to be shown.

Mr. Weatherly: Well, I want to assure you, Mr. Boyce, that it can be done.

The President: Mr. Massey has a letter I would like to have him read to you.

The Secretary: The letter is from J. B. Wilt, general superintendent of the Parsons Pulp & Lumber Company. He had intended to come to the meeting and he sent in his regrets and then states:

"We are at this time particularly interested in the subject of preservation of paper mill roofs by K. Barth. We are rebuilding our machine and wet room, which was a frame building constructed in 1900. Since which time a part of the roof has been renewed. When we began dismantling the old building we found even the roof which was renewed about five years ago very badly decayed; in fact, we do not believe the building would have stayed up another year. The posts and cords were badly decayed, but the rafters in particular were in such condition that it was impossible to get them down without breaking. The trusses for our new building are built up from 3"x10" spruce with 3"x6" T. & G. hemlock for sheathing. In order to preserve the timbers we are using a very heavy coating of asphalt and graphite roof paint between the timbers—in fact, we are using a liberal quantity of paint on the ends of all braces and posts and every place where the timbers come in contact. We are also painting the sheathing before putting it on, as well as the rafters. With the precautions which we are taking, together with a Sturdevant Hot Air System for drying, we do not contemplate any further trouble for a good many years. We thought the above would be of interest to you as we have not seen any account of this method being used in the preservation of paper and pulp mill roofs."

Mr. Barth: Mr. Chairman, that method of treatment is the worst thing he could do. As I explained, and showed you in a slide, when you apply a sort of water-proof coating to a piece of timber, unless that timber is absolutely bone dry, and it is going to remain so, you are advancing rather than retarding the development of decay. Why? As an illustration he painted asphaltum paint on the lumber. As long as that coat of viscous paint, and that is all it is, remains intact you have merely given mechanical protection to the wood. The average piece of wood before it ever reaches you is infected with fungi spores and these spores cannot be killed by an application of paint, asphalt, etc.; they can only be killed and eradicated by a toxic agent, something that is poisonous to these organisms, something that won't permit them to live and develop. Lumber infected with fungi, then, is placed in a roof deck; perhaps it is only partially seasoned or green—the coat of viscous paint prevents natural seasoning, possible under the conditions, the paint soon dries and cracks admitting air and the humidity of the machine or beater room, with the result that decay will develop more rapidly behind this coating, and the added danger of the paint hiding the actual decayed condition of the boards and girders. A preservative can only be a material which is toxic, which is poisonous to these wood destroying organisms.

Now, on the other hand, if the kind of treatment that this gentleman wrote about would be applied to an exterior structure, we will say, where the air could carry spores of fungi to the timber where it is not enclosed, and we will say also that the timber was not infected before it was thus treated,

then you have a condition where, when that coat of paint cracks and exposes the untreated wood the spores will settle in the crevices. They are so minute that you can hardly see them when enlarged 500 times. Behind that coating which protects them to a certain extent, the fungi will then develop with greater rapidity. You have enclosed them in the interior of the wood with plenty of palatable food, air and moisture and that is the reason you see the condition that I have before illustrated.

That is the point I want to emphasize, that in order to destroy decay you have got to destroy the organisms that cause it, and the only way that you can do that is by a toxic agent which will remain permanently toxic.

The President: I think here is a place to show the Paper Mill Superintendents' Association is some good. Now if you have no objections I will instruct the secretary here to write to Mr. Wilt that he read his letter before this meeting and they absolutely did not agree with him, that he was making a mistake. Are there any objections to that? (It was so ordered.)

The Secretary: Well, let's hear some other views.

The President: Dr. Kress, we would like to hear from you. That is my thought. We would like to have as many facts on this subject as possible.

Mr. Dailey: What is the objection to a concrete roof?

Mr. Milon: It is not water tight without it is treated on top with asphaltum.

Mr. Barth: Regarding a concrete roof, I heard a good suggestion a while ago. A man asked how he could build a concrete roof and still prevent condensation. The answer was to put in an air drying apparatus and about a three inch deck of creosoted lumber on top of the concrete roof deck and then a five ply felt, pitch and gravel roof. I do not know whether the suggestion is good or not. I will leave it to you to decide.

The President: Any further discussion?

Mr. Jennison: May I say just one word? I just got in town. Mr. Weatherly is with us. I heard his talk and I heard the others. I want to say if there is any paper man here represented who thinks he cannot get a perfectly dry floor on any of the three floors or five floors of his mill, if he will just drop a line to Mr. Weatherly he will be shown, and if he is not satisfied he will get an iron clad guarantee.

The American Box Board Company and the Keystone Paper Company are using them and recommending them and giving commendatory letters about them.

Now when it comes to comparing the degree of slipperiness of a creosoted block and a concrete floor there is quite an argument there. It is true that with water and with damp conditions a creosote block is slippery. But isn't concrete slippery?

We contend that creosote blocks are the proper things for floors and we maintain a very good corps of competent engineers and experts. It will cost you nothing to be shown and then if you are still in doubt you can get a very good liberal guarantee.

Where strong acids and bleach is used in large factories in this country they put them down because they will not let the acids and other things affect the steel structure. Just within the last month one of the largest engineers in Milwaukee specified 90,000 feet in one of the largest factories, five floors. That was a branch of the National Enamel & Stamping Company. People like that, who have in their employ the best engineers in the country, must be making no mistake if they come to the conclusion that that is the floor for them.

Mr. O'Connell: I want to say that I have creosote blocks where I could not keep a cement floor at all which have been in there three years and this floor is not slippery; and it is very, very satisfactory.

Mr. Jennison: What plant is that?

Mr. O'Connell: King Paper Company.

Mr. Barth: Mr. Chairman, I haven't heard anybody ask anything about the details of treating; I mean by that particularly about the cost.

Now, it is necessary to postscript, so to speak, what I said before. Today, with the open tank process, which can be used in your own plant, it will run about 25 per centum of the cost of your lumber. The pressure processes will run a little higher than that. As I said before it largely depends upon the condition, what method of treatment is to be used. The safest thing to do if you are facing a job of repairing, if you are facing rehabilitation, which includes timber, under conditions where the timber is to be exposed to decay, is to get the advice of an expert and let him survey the situation and make his recommendations, based upon what is the cheapest per year of service.

The President: Is there any further discussion? If not I will take this opportunity to say a few words, as there are probably as many of you present at this time as will be able to assemble together for at least another six months. We are young, the youngest organization in the paper industry and while we have quite a number of new faces here who I am sure will be boosters for this association when they go home, we need more boosters in order that it may develop to be the strongest and most important organization in our industry, and take the position to which it rightfully belongs. We are growing, and growing very rapidly. Our membership in the east at this time is not very large, and although we have members from every eastern state, they are only a small percentage of what we ought to have and what we will have; this is due to the fact that we have not as yet organized any local divisions in the east, but I wish to assure you that this will be done in the very near future and that, when we have our next National Meeting, there will be a large number of new divisions represented. In the middle and northwest, we have developed even more rapidly than any one of us had any idea, so that at the present time we have practically every superintendent with the exception of those employed by two companies. In every instance, without exception, where the manager or owner of a mill has investigated us, or attended one of our meetings, he has instructed his superintendents to join our organization and attend the meetings and furnished them with the necessary funds to do so. In two instances, however, the mills have decided against us, but I am pleased to say, however, that in neither case has the management attended one of our meetings nor given the subject any study; they have just given it snap judgment without any investigation and like all cases of snap judgment there is still the possibility of a change of opinion or a change of management and that the superintendents from these mills will be instructed to join the association. Now, in a case of this kind, we always abide by the managements decision and we do not write to them or attempt to influence them in any way, as we figure that the management ought to know what is best for their organization or they would not be in that position.

Now, I think that in a very short time we will have every paper and pulp mill superintendent in the United States and Canada as members of this association and that we will see many more managers and owners attending our meetings, because in the first place they are welcome and in the second place I am sure that even they can learn something of value at our meetings.

Now, in regard to finances, you all know that to carry on a proposition of this size requires money and that some of you fellows have not paid your yearly dues of $10.00, which by the way, is the only charge attached to membership in our organization. You know it takes a lot of financing to pull this thing through right, so I hope that all of you fellows will come across with your ten dollars.

Now I don't want you to be under the impression that we are broke or are in debt like almost every organization is at the same period in their development that we are passing through at the present time, because that is not the case with us, instead of being in debt we have a good sized bank account as I have been informed by our Finance Committee who have just examined our books, but as you all want to be real members I want you to understand that it is not only necessary for you to fill out the application, but you must also pay one year's dues in advance to entitle you to full membership privileges.

I also want to thank the men who so kindly assisted Mr. Massey in making such splendid arrangements and running this thing off in regular army style, that is, every thing on time and time for everything. I know that Mr. Dial, Mr. Panushka, Mr. Costello, Mr. Yule, Mr. Wilcox and Mr. Beeson and all of the other gentlemen that acted on the committee have given some of their very valuable time to make this thing a success.

I have met several friends of mine here at this meeting, men who I have not seen for many years. Now, there is Jack O'Connell down there who I haven't seen for twenty-five years. He came up to me yesterday and said, "I used to work with you twenty-five years ago, you don't know me, but I know you all right." That is one of the benefits you derive from an association of this kind, you get the opportunity to meet a lot of mighty fine fellows who you have not seen for years and it gives you a chance to talk about old times, how we used to make paper in those days when we were working together and how we are making our paper now. I think that it is a mighty fine thing to get together once in a while and talk shop, because when you go back home you feel ten years younger and I am sure that you all feel the same way about it. Now, there is Mr. John Dailey over there. We have known each other for the last twenty years, but it is only on occasions of this kind that we have an opportunity to meet one another. Then there is Mr. Dan Davern and a few other friends down here from Canada, I hope that they are pleased

with both our meeting and our organization, not our organization exactly, but their organization, for it is as much theirs as it is ours.

Mr. Massey informs me that he has made arrangements to have the Sulphite Pulp Superintendents and the Board Mill Superintendents hold their committee meetings this afternoon, the rooms will be ready for you at one o'clock. This afternoon's meeting will be a combined meeting of paper mill and printing house superintendents, so I believe that the pulp and board men will derive more benefit from discussing their own problems than attending the big meeting, which will be given over to printing papers and printing.

Now, before I close, I want to again ask you to be a booster for this organization. Boost it right along. No matter where you are or where you go, Be a Booster for the American Pulp and Paper Mill Superintendent's Association. I thank you. (Applause.)

The Secretary: Gentlemen, the value of this association to the Management was covered very nicely in the words of Mr. Edmonds at the recent meeting of the Wisconsin Division at Wausau, when he said, "I always notice that every time my superintendent attends a meeting of the association, he comes back full of pep and ten years younger than when he went away, and this pep not only affects the superintendent, but it permeates the whole organization and is clearly manifested in our production sheets." Now, Mr. Edmonds ought to know what he is talking about because the superintendent he referred to is our worthy president.

The President: If there is further business, we will now stand adjourned.

Whereupon adjournment was taken until one o'clock P. M. of the same day.

The proceedings of the combined Paper Mill and Printing House Superintendents will be published in the February number.

A Few Notes on the Manufacture of Box Board

(*Continued from Page 849*)

dium and heavy grades. Board calipering eighteen to twenty points can be run as fast as 175 feet per minute. This may be taken as a very rough approximation of the limit to which drying capacity may be carried.

There is considerable diversity of opinion on the part of machine builders as to the rate of drying, the range being from 0.5 lbs. to 0.75 lbs. per square foot of dryer surface per hour. The higher figure is probably nearer right than the lower with a proper system of drainage of condensation from the dryers that will provide for the removal of air as well as water.

Dryers 42 inches in diameter are probably more universally used than other sizes, although 48-inch dryers are being used to some extent and 36-inch dryers are found on older machines. Dryers are arranged both two high and three high, although the latter arrangement is open to the objection of unavoidable pocketing of vapor in the draws to a greater extent than in two high dryer banks, but the floor space required is materially less. Dryers arranged in vertical stacks and threaded in the same manner as calender rolls are offered by one builder and are meeting with favor, as this arrangement makes possible a much shorter overall machine length and allows better reparation of vapor from the sheet.

Dryer Felts, Calender Stacks, Reels, Etc.

Bottom dryer felts are used on machines for making the lighter weights, up to sixteen or eighteen points.

Calender stacks are commonly seven to nine rolls high. Two stacks are most commonly used, but three stacks are not uncommon.

Reels are used for the lighter weights, but are of no advantage for the heavier weights, as the sheet can be led directly through the slitters to the winder.

Cutters are most commonly duplex, occasionally triplex, depending upon machine width, and this consideration also applies to the winder, three- and four-shaft winders being used on machines of about 110-inch trim. Cutters are commonly driven from the variable speed line shaft through speed changing devices, but independent constant speed drive, by motor for electrically equipped mills would be preferable with the drum rolls only driven from the constant speed line as less adjustment to secure the desired sheet length would be necessary.

Machine drives are the standard Marshall type, with the exception of the dryer drives, which are back geared to operate at the lower speeds without impractically low belt speeds.

The tendency has been toward larger dryer banks, 100 dryers being about the maximum, which has required installation of multiple dryer drives to allow for the shrinkage of the sheet in drying.

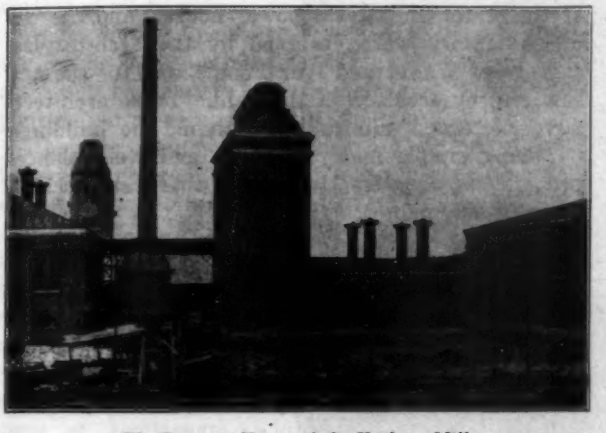
With the increased machine capacities being obtained, provision for the removal and disposition of "broke" becomes necessary. For this purpose a fairly deep pit under the machine is necessary, and a fairly high basement desirable. The installation of a broke beater under the machine takes care of the broke economically, the broke being well beaten and pumped to filler jordan chests.

The Varkaus Cellulose Factory Varkaus, Finland

By JAC. KAUSTINEN

THE cellulose factory at Varkaus, belonging to the firm of A. Ahlstrom Co., Helsingfors, made its trial run at the end of April last year, and is now in full swing. Some facts about the first cellulose plant to start in Finland among all those now being built, may be of interest to our readers.

The construction of the factory was begun in March, 1915, and it has been erected and equipped during the World War and the Finnish War of Liberation. It is obvious that under these circumstances the project has met with many difficulties. For instance, the bricks for the digesters were twice sent to the sea-bottom, and the third consignment was the first to arrive.



The Digester House of the Varkaus Mill

The different departments of the plant are housed in three separate buildings. The first building contains the acid house and wood room both for the sulphite and ground wood mills. In the second are the digesters and pulp-pits and in the third the separators, sand catchers, screens and drying machines.

The pulp wood, which is brought in on cars from the wood yards, is raised by a fourteen-ton traverse crane to the wood room situated on one of the upper floors of the factory. The wood is first put to soak, whereupon a conveyor carries it over a crosscut saw (for the cutting of long logs) to a table where two slowgoing chains feed it to the barkers. Three such machines have been installed of the Bezner type. The barked wood is conveyed upon rollers directly into the chippers. The latter have been supplied by the Karlstad Engineering Works, and the knifeplates have a diameter of 2.8 meters. The chips are automatically thrown from the chippers into the disintegrator, also furnished by the Karlstad Engineering Works. From the disintegrator the chips are conveyed to two Bezner oscillating sorting-machines, which separate them into three qualities: Sawdust, blown down into the boiler room, pulp chips, carried by conveyors to containers above the digesters and knots, which are lifted by an elevator to a crusher (made at Götaverken), from which the crushed knots pass anew into the sorting machines.

Two digesters of 250 cubic meters net volume have been installed. They came from the Thune Engineering Works, where a third is being made. The wood is cooked by direct-pressure steam, and when ready the pulp is blown at a pressure of 1½ to 2 kg. into the pulp bins, which are rectangular in shape, 18x5.4 meters. A Nygren scoop carries the pulp from there to a conveyor which brings it to the separators.

These Nygren system separators coöperate with two Nygren knot-removers. The entire system was made by the Engineering Works at Karlstad and works most satisfactorily. The pulp then passes from the knot-removers over a sand-catcher and thence to the screens. These, also manufactured by the Karlstad Engineering Works, are of the Spangenberg type, with three fore-screens and one hind-screen of the same system. The work with the Spangenberg screens presented difficulties at the beginning, due principally to ignorance of their exact use, but now they meet all requirements. The screened pulp is thickened in two drainers, which came from the Tammerfors Linen and Iron Manufacturing Company, and runs from there to the stuff-chests of the drying machines. This machine, which

The Nygren Separators at the Varkaus Mill

has a working width of 3 meters and 44 dryers, was built by the Engineering Works at Karhula, and is an ornament to the Finnish domestic industry. From the start the machine has given great satisfaction. Exhaust steam at a pressure of only 1.5 atmosphere is used for the dryers, but at present only about 0.1 atmosphere is needed. The result is that the cellulose does not get burned on the machine, but keeps its white color. Partly on this account, and partly for other reasons, the factory is producing an intensely white unbleached cellulose.

For the purpose of packing and baling, whereby the pulp can be compressed to the size of no more than 1.15 cubic meters to the ton, a high pressure hydraulic press from the Karlstad Engineering Works has been installed.

The factory was designed for a daily production of forty tons with two digesters and sixty tons with three. Because of the impossibility of getting certain machinery and instruments, the production has so far only reached about thirty tons per day. The manufacturing process and up-keep of the buildings require a force of fifty-seven men and twenty-four women and only a few more are needed when the production is increased to sixty tons a day. The completion of the Varkaus sulphite mill is one great step of the plan to make that place a center for the wood industry.

The grinding department with its eight immense storage grinders was started in 1916. The great saw, burned down in the course of the war, has risen like Phoenix, larger and handsomer, out of the ashes, and will start with six of its eight frames early in 1920.

For the paper mills, planned for two high-speed news machines, one machine has already been ordered.

All these Varkaus factories are equipped with machines filling the highest requirements of modern technique. But technique alone has not so completely engrossed the builder's mind, as often happens in the erecting of factory buildings, that the claims of the esthetic sense have been ignored. The facades of the water and steam power houses, and the cellulose factory were designed by the architectural concern of Walter and Ivar Thomé, and for the new saw mill by architect K. Lindahl. These architects have succeeded admirably in giving the buildings, by using simple and pure lines and well-balanced proportions, an attractiveness of appearance that is literally astounding.

The Michigan Meeting

In spite of the severe weather and below zero temperature, the Michigan division of the Superintendents' Association had a very successful December meeting.

The program was an interesting one and very much appreciated by those present, and consisted of an illustrated lecture on "Power Transmission Problems" by Dr. E. D. Wilson and an address by Peter J. Massey on "Paper Requirements for the Rotary Printing Press."

Both were severely grilled in the discussion that followed each address, and a lot of valuable material was made available to those present. All the important points made by the speakers were discussed at length, which brought out considerable technical information that otherwise would not have been brought forward.

The Michigan Division is to be congratulated on their progressive and "show me" spirit displayed at their meetings. Their penchant for questioning the speakers redounds to their benefit in many ways. Not only do they go away satisfied that they have received something worth while by having all the questions they had in mind answered, but they also make the speakers of the evening feel that the superintendents were interested and appreciative of their message.

The program for the January meeting is exceptionally good, and all the members should turn out for the meeting on Monday the 19th. The program will be:

"Colloidal Chemistry in Paper Making," by W. A. Darrah.

"The Printing Press Make-ready," by Peter J. Massey.

"Boiler Room Efficiency," by J. F. Carrigan.

Any one of these will be well worth your time.

Among those attending the December meeting were the following: John H. O'Connell, King Paper Co.; E. T. A. Coughlin, Monarch Paper Co.; Peter J. Massey, W. E. Hall Printing Co.; Frank D. Libby, Vegetable Parchment Co.; E. H. Gilman, Bryant Paper Co.; C. L. Harter, Rex Paper Co.; N. J. Niks, Vegetable Parchment Co.; Jacob Kuss, King Paper Co.; George H. Davis, King Paper Co.; Charles G. Bard, paper jobber; M. Redmond, Kalamazoo Paper Co.; G. A. Shoemaker, Gratou & Knight Co.; E. H. Cornell, Gratou & Knight Co.; Frank Murphy, Lockport Felt Co.; W. H. Scott, Kalamazoo Paper Co.; A. McPhillips, David Knife Works; George Pountain, Monarch Paper Co.; Dr. E. D. Wilson; H. De Young, King Paper Co.; C. E. Draper, F. E. Walter, W. P. Williams, R. C. Moore, James Blease, James Jolly, F. A. Johnson.

Liquid Level and Condensate Controller

THERE has been a long-felt want for an easily applied, simple and dependable device, for automatically maintaining liquid levels in evaporators, closed and open tanks, etc., also for draining the condensate from heating, drying, cooking and evaporating apparatus used in the paper industry, and capable of handling any volume, either under vacuum or pressure, in place of the somewhat crude means employed up to date.

At present, for removing condensate, pumps, traps and barometric leg pipes are employed. Neither, in many cases, have been entirely satisfactory—the pumps because they need attention, and are costly to operate—the traps because they usually lack capacity, require frequent manipulation and for handling large volumes of condensate, a costly equipment is necessary — the barometric leg pipes, because of the considerable space required.

To obviate the difficulties experienced with present methods of liquor feeding and condensate drainage, Messrs. Pattno and Witham, well-known chemical and paper mill engineers, designed and invented the P. & W. Controller outlined in this article, which has achieved a remarkable success in a comparatively short time, and has proven itself a simple, dependable and effective device.

The controller for either level or condensate performs its functions through the medium of compressed air, which, because of its power and positive action, at all times insures satisfactory operation. Compressed air also makes possible the use of standard valves of any size, and workable against any pressure, which accomplishment is virtually impossible with other forms of self-contained controllers, using no auxiliary motive force.

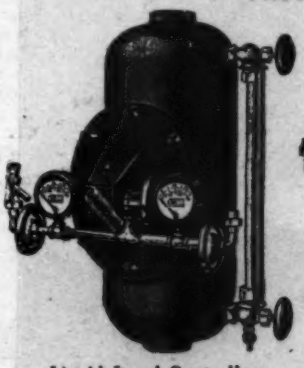
The perfected device was not introduced until we were satisfied, after a two years' demonstration under actual operating conditions in several plants, that it was all that it should be.

All the parts are practically unbreakable so nothing will give out except through unavoidable deterioration, and there are no delicate adjustments to cause annoyance.

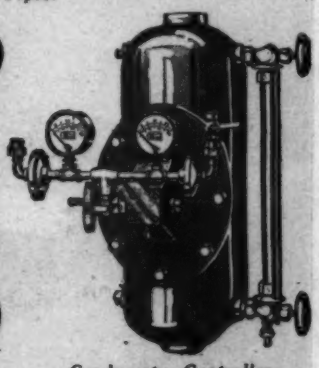
The mechanism of the controller and its operation are both extremely simple, and therefore easily comprehended by anyone.

The accompanying illustration and following description show the diaphragm-motor valve consists of a regular globe valve body, on which is mounted a spider which supports the diaphragm top. The motive force (compressed air) enters at the top of the diaphragm chamber, which latter consists of a convex casting with a rubber diaphragm across the bottom. A saucer, which is recessed to hold the end of the valve stem, is held against the rubber diaphragm by a spring surrounding the valve stem. When there is no air within the diaphragm chamber, the spring presses the saucer against the rubber diaphragm and holds the latter against the inside face of the cast top, and at the same time the spring forces the valve stem upward so that the valve is wide open. When the motive force enters the diaphragm chamber, it

Level Controller Applied to a Standard Quadruple Effect, with Its Two Diaphragm-Motor Valves on the Two Liquor Feed Pipes.



Liquid Level Controller



Condensate Controller

overcomes the resistance of the spring and causes the rubber diaphragm to press the saucer against the valve stem which partly closes the valve. As the pressure within the chamber increases, it thus causes the valve to be less and less open and finally forces the valve to close entirely. If the pressure within the chamber is relieved, the valve starts to open as already explained, through the action of the spring (the pressure of the heating or cooling medium which passes through the valve body also aiding in keeping the valve open).

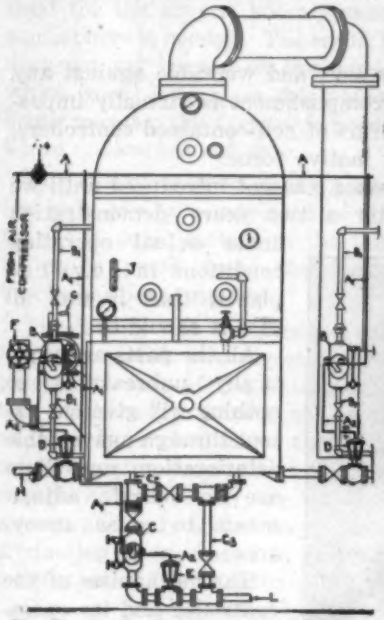


Fig. No. 4—Application of the Automatic Liquid Level and Condensate Control to an Evaporator

Fig. No. 5—Application of condensate control to a heating system

Compressed Air Requirements

These controllers, for either level or condensate, perform their functions through the medium of compressed air, which because of its power and positive action at all times, insures satisfactory operation and also makes possible the use of standard valves of any size, and to work against any pressure, which is virtually impossible with all self-contained controllers, using no auxiliary motive force.

The volume of compressed air required is very small, and the pressure very low, only 15 lbs., but this air pressure must be maintained without any appreciable variation. There generally is no trouble met with in providing air of such pressure and in such condition.

If compressed air is available and at a higher pressure than 15 lbs., it can be utilized and reduced by means of a suitable air-reducing valve.

If no compressed air is available, suitable small air compressors, completely equipped for this service, can be supplied at reasonable cost.

Advantages of Liquor Levels Controllers

I. Automatically maintains the liquid level in the evaporators under vacuum conditions at the exact height required.

2. Always keeps the liquor above the tubes.

3. Never allows the evaporators to get too full, thereby preventing entrainment.

4. Has increased the capacity of evaporators at least ten (10) per cent, by keeping the liquor at the level where it will circulate and boil to maximum.

5. Eliminates the uncertain human equation—thereby increasing production and reducing labor cost.

Advantages for Condensate Discharge

1. Will handle any volume of condensate, its only limit being the size of the diaphragm-motor valve.

2. Will pass vapor condensate from one steam chest to the other, thus utilizing the heat units of the condensate and eliminating condensate pumps.

3. Controls the speed of the condensate pump so that it cannot lose its suction.

The Liquid Level Controller will readily operate two or three valves if there should be more than one liquor inlet to the apparatus.

Fig. No. 6—Condensate Control Applied on a By-pass of an Exhaust Main of a 156-Inch Pusey & Jones Paper Machine Dryer.

Acid Resisting Metal Chamber Float

Where the standard cast iron float chamber cannot be used owing to the nature of the liquids, a bronze or brass float chamber is furnished that successfully resists acids.

Aladdin

The Ford Collieries Co. Housing Problem Solved by the Aladdin System

The mines of the Ford Collieries Co. at Bairdsford are far removed from a community center. Naturally a housing problem existed. The owners presented their problem to The Aladdin Company for a QUICK solution. In less than four weeks after the order was placed, workmen began to occupy finished houses. The picture shows fifty Aladdin houses SIX WEEKS after the job was started. This is only one of the many similar services rendered by us to meet the existing house shortage.

HOUSING YOUR MEN WELL AND QUICKLY AT LOWEST COSTS

The Aladdin System of Construction saves 18% of the lumber wasted in ordinary building. Standardization and quantity production further reduce the building cost to you and you benefit by Aladdin's stupendous purchasing power. Aladdin houses are easily and quickly erected by unskilled labor. Simple, complete instructions are furnished with each house.

THE ALADDIN SYSTEM AND PLAN

Aladdin houses are Readi-cut. Every piece of joists, studs, rafters, sheathing, siding, flooring, interior finish is cut to proper size, marked and numbered ready to nail in place. Sufficient material to complete more than 1,000 houses is carried constantly in stock ready for instant shipment. Depending upon size of house, we load from one to three complete houses in each car.

Aladdin houses are manufactured and shipped direct from the Aladdin Company's own mills in Michigan, North Carolina, Oregon and Canada. Aladdin houses come to you in a straight line from the nearest timber region. Aladdin's Industrial Homebuilding Service means shorter routes, quicker delivery and lower freight rates for builders in every part of the U. S. Three days to a week are saved in shipments reaching destination. Complete Sales and Business Offices are maintained in connection with each mill. Fully 24 hours time is saved in your mail reaching our offices.

SINGLE HOUSE OR COMPLETE CITIES

We will quote you a definite price on a single house or complete cities of 300, 500, 600, 1,500 and 3,000 population. These cities include homes, stores, churches, schools, offices, water and sewage systems, electric plant, street and house lights, heating plants, streets, parks, trees, lawns, etc. Cities are now listed in our book "Industrial Housing." Write, wire or phone for book No. 1822.

The Aladdin Co.

Offices and Mills at

Bay City, Michigan; Wilmington, North Carolina; Hattiesburg, Mississippi; Portland, Oregon; Toronto, Ontario.

Industrial Housing

Does Your Superintendent Know?

In most paper mills manufacturing more than one line of product, the order does not reach the superintendent with specifications that are sufficiently definite to give him a complete understanding of the requirements that each particular product will be expected to fulfill at its destination. In fact, he is but seldom, if at all, made acquainted with the specific purpose for which each particular order is being manufactured. However, it will be the superintendent that is held to be the responsible party, when the finished product fails to give perfect satisfaction to the customer.

The manager of a large mill manufacturing specialties always calls in his superintendent for consultation on every order that is received by the mill. All the information at hand in regard to the requirements for each order, such as the purpose for which it is intended, and the atmospheric and other peculiar conditions at its destination, are thoroughly discussed. Should the information on hand be insufficient, the manager writes for further instructions and in some instances goes personally to investigate the conditions.

On one particular order for a large tonnage, both the manager and superintendent investigated the conditions under which their product was to be used, so that they could more fully understand the conditions under which it was to be used and be thereby the better enabled to produce a paper that would give perfect satisfaction.

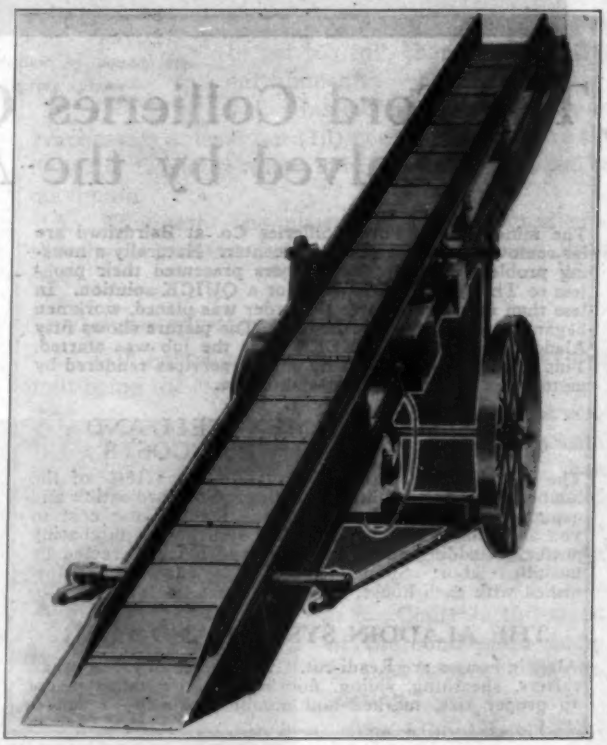
As an example of the benefits that will accrue to the mill that gives this particular kind of service, it is well worth mentioning that in the foregoing instance the order was converted into a contract for a term of years at a liberal premium over the prevailing market price for this grade of paper.

The superintendent who knows the exact requirements expected from his paper and the actual conditions under which it was to be used, was enabled to follow through personally each separate process from the wood yard to the finished product and put into effect several small changes in the procedures of some of his departments with the result that the finished product gave perfect satisfaction to the consumer.

(*Continued from Page 866*)

conveyors are quite obvious. One long conveyor would not be as portable. It would be more difficult to adjust and handle and the shorter units can always be used to better advantage for general work about the plant.

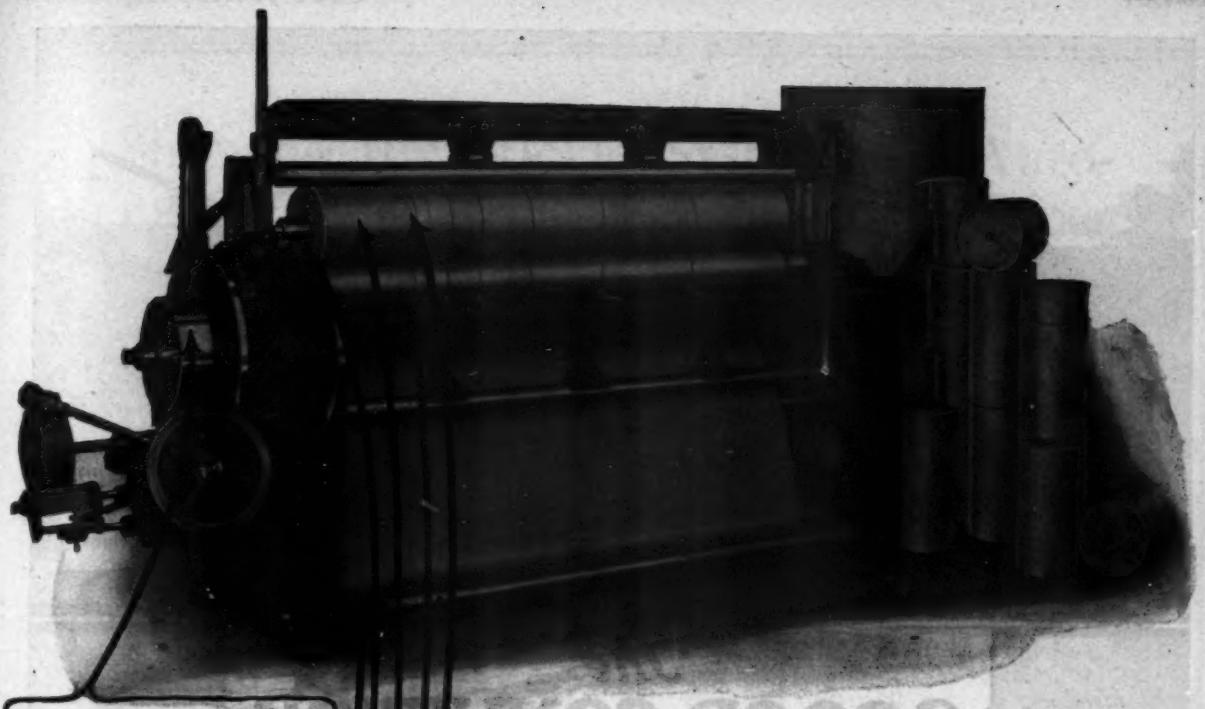
A great advantage of using the scoop conveyor to unload hopper bottom cars is the fact that no



5—*Scoop Conveyor Fitted with High-Flight Belt*

track hopper or pit is necessary. This makes it possible to unload cars at any point along the track. To unload a car, the scoop or feed end of the machine is placed near or under the car hopper. The hopper door is then released and the belt on the scoop conveyor carries the material away as fast as it flows through the hopper opening.

Figures 4 and 5 clearly show the construction details of the scoop conveyor which has been previously described in the technical press.



High Speed Drive

Treadle Control Variable Speed

Even Edges

Firm Even Tensioned Rolls

Quick Change of Cutters

Clean Cut

A FEW Important Features of the Cameron Principle Slitting and Rewinding Machine

The advantage of the Cameron "Score Cutter" method, considered apart from the fact that it is the ideal method to combine with the Surface Rewind, may be summed up as follows:

1. The "Score Cutter" does perfect work on any kind of paper made, as well as fabrics and other materials.

2. The "Score Cutter" gives a clean, smooth slit and does not stretch the edge of the paper.

3. The "Score Cutter" will operate perfectly at unlimited speed as there is practically no friction or wear on the cutting edge.

4. The "Score Cutter" need not be kept to any special diameter, as the pressure spring will take up any variation.

5. The "Score Cutter" does not have a keen cutting edge, but an edge slightly blunt like a cold chisel, and it is easily kept in prime condition by the operator.

6. The same features which make the "Score Cutter" efficient for light duty, make it equally serviceable for heavy duty, as it will handle work from the sheerest tissue paper up to box board.

7. Re-spacing of "Score Cutter" is quickly done by simply releasing the spring pressure on all the cutters at once, and sliding the cutter holders to the new positions.

8. Re-spacing of "Score Cutters" requires only five to ten minutes for any new arrangement of widths. When Gang Spacers are used for narrow strip, even less time is required.

9. Removing or replacing a cutter requires only to lift it on or off its support—holder and all—without disturbing any other cutter or any part of machine.

10. Any width or assortment of widths can be spaced from one-quarter inch up.

11. Strip as narrow as one-quarter inch can be produced by special "Score Cutters."

12. The waste or trim at the edges may be extremely narrow.

13. The rolls produced do not interweave or stick together.

14. Injury to the operator by this method of slitting is impossible.

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SCOOP CONVEYOR

A Convenient and Flexible Machine
for Loading, Unloading or Transferring
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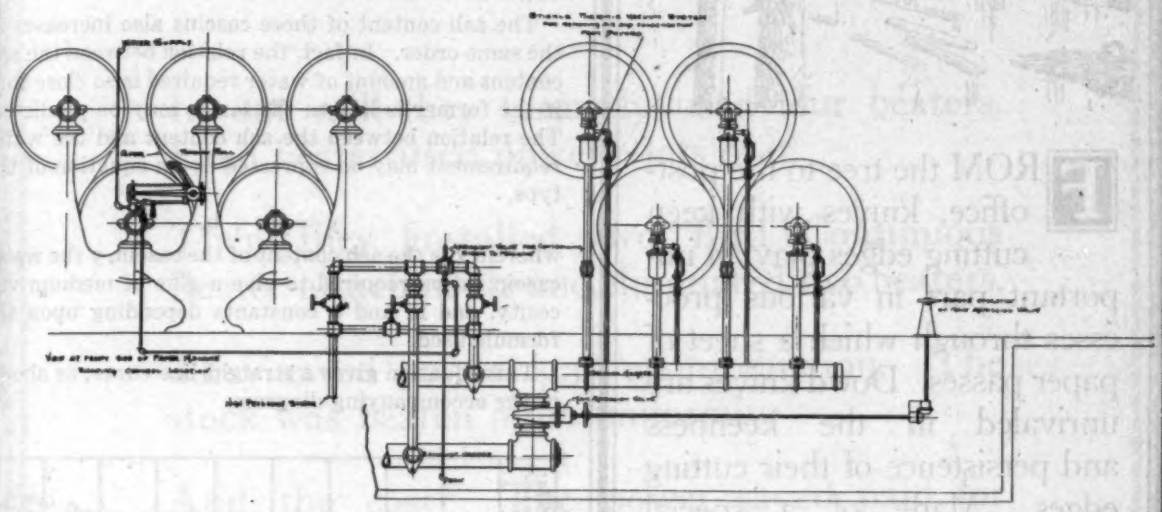
1 Man and a Scoop Conveyor Can Load a Truck in ⅕ the Time of Hand Shovelling

Showing the Stickle System for Automatically Controlling Steam to the Paper Machine and the Stickle Thermic Traps for Removing the Air and Condensation from the Dryers



THERE is no trouble in drying a sheet of paper evenly if the water is removed from the dryers as fast as it accumulates and the steam automatically controlled as it is needed. No one can dispute this. If they do, we wish to state that we can convince the most skeptical. We furnish all of the equipment on sixty days' approval to confirm our statement. Most of the largest mills in the United States and Canada are using our equipment. Let us make you a proposition.

OPEN COIL HEATER & PURIFIER CO.

INDIANAPOLIS, INDIANA

FROM the tree to the post-office, knives with keen cutting edges play an important part in various processes through which a sheet of paper passes. Dowd knives are unrivaled in the keenness and persistence of their cutting edges. Made of a special Swedish steel, recognized as the best material for this purpose, Dowd knives are the perfected product of a long and successful experience in knife making. The name Dowd on a knife has come to be more than the mark of its maker—it is the brand of quality—the accepted standard by which knives are judged.

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R. J. Dowd Knife Works

Makers of Better Cutting Knives Since 1847

BELOIT, WIS.

Effect of Casein Impurities on Water Requirement of Casein Glue

Experiments at the Forest Products Laboratory indicate that practically all caseins of a reasonable degree of purity can be made into satisfactory glues by the same formula, simply by varying the amount of water used.

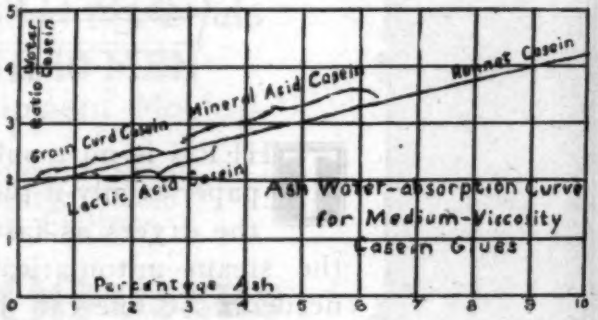
Caseins may be divided into definite groups according to the amount of water which they require to make glue of a given consistency. This grouping is roughly the same as the grouping according to methods of casein manufacture. Grain-curd casein requires the least water; lactic-acid casein, ordinary mineral-acid casein, and rennet casein increasingly larger amounts.

The ash content of these caseins also increases in the same order. In fact, the relation between the ash content and amount of water required is so close that if the former is known the latter may be predicted. The relation between the ash content and the water requirement may be expressed by an equation of the type,

$$y = mx + b,$$

wherein x is the ash content of the casein, y the water casein ration required to give a glue of medium viscosity, and m and b constants depending upon the formula used.

This equation gives a straight line curve, as shown in the accompanying diagram.



Formaldehyde has been used in some manufacturing processes to coagulate casein, but as an agent for rendering casein glue less soluble it has not proved successful.

Discoloration of casein on heating to 212 degrees Fahrenheit is due to the presence of lactose, and indicates that the curd was not very thoroughly washed. Absence of such color change indicates well washed curd, except in the case of natural sour casein precipitated from very sour milk. No discoloration is then noticed, because all the lactose has been converted into lactic acid.

Continuous Beating

In one mill they formerly used four beaters. Each beater used power—lots of it.

Then they installed two Bird Continuous Beater attachments and eliminated two beaters.

They saved power, kept up production. The stock was beaten more uniformly.

And the cost? The power saved paid for the attachments six times the first year.

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We are prepared to deliver promptly
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Auramine	Bismarck Brown
Basic Green	Pulp Colors
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Our Own "NACO" First-Aid Canisters
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NATIONAL APPLIANCE CO.
ELGIN, ILLINOIS

Miami Valley Paper Interests Recognize Employes' Loyalty

CHRISTMAS cheer came in a substantial way to the 300 employes of the Paul A. Sorg Paper Company and W. B. Oglesby Paper Company, allied paper manufacturers, when they were presented with gift checks calling for amounts based upon their length of continuous service and their present rate of pay.

With each check was a neatly printed card on which appeared this greeting from their employers:

"The officers of this company appreciate the efforts of the employes to aid in making our business successful. That appreciation is expressed by the contents of this envelope—the Christmas gift of the company to you.

"The amount of this gift is based, first, upon the length of time of your continuous service with the company, and secondly, upon your rate of pay. Those who have given years of continuous service to the company will see by the amount of the gift that the officers know of and are appreciative of such loyalty.

"Men who went forth into the army or navy in our late emergency will observe that their service is regarded as if it had been continuous.

"We wish you a merry Christmas and hope that with your co-operation we may all enjoy a prosperous New Year."

This splendid gift came as a happy surprise to the employes of both plants and reflected in no mean way the companies' appreciation of their employes' loyalty.

Today each employe, no matter if he or she has been in the employ of either of the companies for one day or for twenty years or more, was thus remembered. The amount was graduated on a basis of the present rate of pay and upon the length of time they have been continuously connected with their present employers.

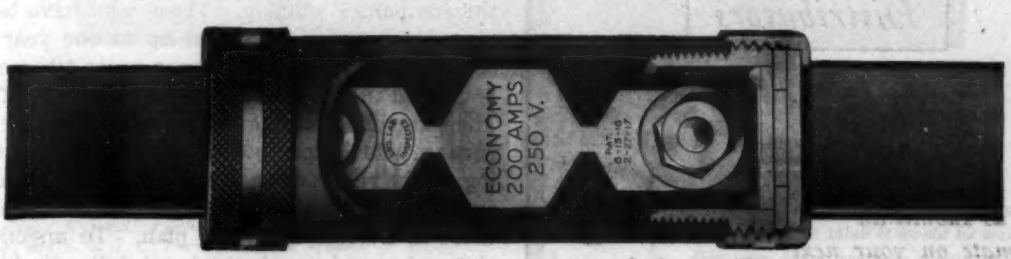
The amounts paid range from $3.45 to an employe whose service has continued thirty days or less, up to $3,360 to some whose service has continued twenty years or more.

It is significant that fifty employes have worked at these plants continuously for more than five years, twenty-five for more than ten years, four for more than twenty years and one man is now in the fiftieth year of his employment with the Oglesby company.

A pleasing feature of this plan is the fact that those men who entered the service of their country in the World War are regarded as having been in continuous service of these companies, although some were absent from their work for more than a year. This, indced, is practical patriotism.

The idea is a new one for the Sorg-Oglesby inter-

ECONOMY FUSES



The only "Approved-in-All-Capacities" renewable fuse using inexpensive bare renewal links for restoring a blown fuse to its original efficiency

December 9, 1919, ECONOMY renewable FUSES, in ALL CAPACITIES, from 0 to 600 Amperes in both 250 and 600 Volts were approved by the UNDERWRITERS' LABORATORIES, established and maintained by the NATIONAL BOARD of FIRE UNDERWRITERS, and now bear the label "Und. Lab. Inspected." ECONOMY "Drop Out" Renewal Links also bear the inspection symbol.

In your future purchases of enclosed fuses be sure to insist that both the fuses and the renewal links, IN ALL CAPACITIES, bear the inspection symbol.

ECONOMY "Drop Out" Renewal Links made approval possible for renewable fuses.

Millions in use for many years.

Ask for and insist upon ECONOMY renewable FUSES and the famous Economy "Drop Out" Renewal Links.

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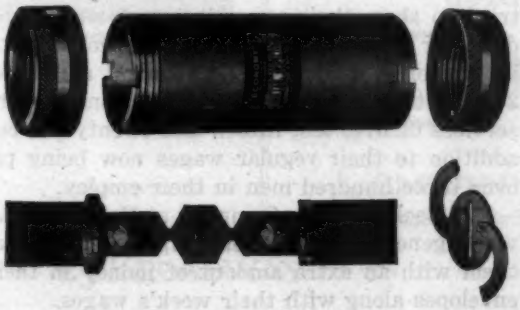
Kinzie and Orleans Streets **CHICAGO, U. S. A.**

ECONOMY FUSES ARE ALSO MADE IN CANADA AT MONTREAL



The Improved ECONOMY Renewable Fuse

Study the renewable link feature. See the two narrow bridges of metal holding the "Drop Out" feature in place. In operation on short circuits, these two bridges fuse. The entire fuse metal does not volatilize, only the two narrow bridges. This very greatly decreases the danger factor due to the tremendous pressure generated when an entire strip of fusible metal is instantly converted into gases. No powdered filler to deteriorate or solidify. Only the fuse metal is destroyed; the fuse itself is ready for years of service. See the new winged washer which makes it simple and easy for anyone to replace the "Drop Out" Renewal Link in a few minutes.

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ests and is a splendid manifestation of the unselfish generosity of the men at their head. It is a just recognition for meritorious service efficiently and loyally given by those who with their brain and brawn have contributed to the advancement of the companies' trade and prestige.

Another evidence of the humanitarian touch these companies maintain with their employes is the fact that during the past year they have inaugurated a group insurance plan whereby the life of every person who has been in the employ of the company more than two months is insured for an amount in proportion to the length of time that he or she has been in the companies' employ. Those who have been employed for two months and up to one year are insured for $500; from one year up to two years, for $600, and in that ratio up to a maximum of $1,000. The companies assume the entire expense for this insurance which does not in any way have any bearing on the rights of each employe under the compensation law. In addition to the life insurance idea, there is a total disability plan. To anyone under sixty years of age becoming totally disabled, this insurance will be paid in installments up to the full amount of the policy as long as the person is alive, the balance due on the policy at the time of death being paid to the beneficiary.

This insurance is in force only while the person is in the employ of the companies and does not in any way affect the right to quit the employment at any time, or the right of the companies to discharge any employe.

The Champion Coated Paper Company, Hamilton, Ohio, certainly did the handsome thing the day before Christmas when Peter G. Thompson, Sr., president of the company, presented to each of the 1,625 employees a gift of a week's wages in addition to their regular pay and bonuses. Mr. Thompson also promised them that this would be done four times during the year, with the proviso that everything went smoothly for the company. This extra week's pay meant about $60,000, and the four other ones will mean something like $250,000 more.

Many of the men and girls had composed a song to Mr. Thompson and gathered in the main office and sang it to him. In this and many other ways they tried to show their appreciation of what had been done for them. The further additional gifts will be paid on April 1, July 1, October 1 and December 24, and this is in addition to the bonuses for time services of five, ten, fifteen and twenty per cent, in addition to their regular wages now being paid to over three hundred men in their employ.

The Beckett Paper Company at Hamilton also provided generously for their employes by presenting them with an extra amount of money in their pay envelopes along with their week's wages.

The three hundred employees of the Black-Claw-

The Symbol of Quality

The Symbol of Quality

LAKESIDE PAPER COMPANY

NEENAH, WISCONSIN

"Our name stands for Quality"

We are manufacturers of Bonds, Bible, Book, Catalogue, Eggshell, English Finish Opacity, M. F. and S. & S. C. French, Myriad Manifold, Tiffany Bond, Glazed, Unglazed, and Embossed, Gaza Onionskin, R. R. Writing, Writing Manila, High Cliff Mimeograph, White and Colored Laid Flats. Also other light and heavy weight M. F. and S. & S. C. specialties.

Quality and Service

From a Jobber:

"We are enclosing an order for two additional cars and think it would be well to add that your paper has been running very satisfactory and that it will probably be some little satisfaction to you to know that we are thoroughly satisfied with this sheet and think it well to give you a word of praise."

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Uniform Quality
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The Signode System delivers Framed Reams, Cases and Bales of Paper with the square corners in perfect condition.

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Plate Press Felts

There is no better Plate Press Felt made than the "HAMILTON."

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Satisfaction always guaranteed.

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offered to invest in Paper Mills, either as a straight paying investment, or active partner proposition. We have for sale, the following dandy propositions:

Fine paper mill site in Vermont on main line of B. & A. Railroad. Part mill buildings and dwellings. Water capable developing 400 horsepower. Also excellent sites with buildings in Massachusetts and New York State. Ground wood plant in New York State with large water power. High-grade paper mill in Massachusetts. Three board mills in New York State and one each in Connecticut, New Jersey and North Carolina. Tissue mills in New Jersey, Pennsylvania and New York State. Wrapping mills in Indiana and New York State. Two second-hand board machines, 72-inch trim.

Gibbs-Brower Co.

Paper and Pulp Mill Brokers
261 Broadway NEW YORK CITY
Telephone Barclay 8820

Our Motto—"Service First"

son shop, also at Hamilton, were remembered in a way that was started some four years ago, which gives each employee extra money in their pay envelopes the day before Christmas so that they might purchase extra things for themselves and family. It is this company's intention to carry this out from year to year.

It is this sort of fellowship and good will shown that ought to and no doubt will make for better employees and better work in these plants, for the employee should see that the employer means to give them everything that it is possible to give, but naturally expects proper service in return. Many of the other mills have done this same thing, which is very commendable.

The Stock Room

The stock room in a mill that has not as yet installed a cost system and is not under the management or supervision of a stock man, is an ever increasing liability and profit leak in paper manufacture.

The formula as handed into the beater room, is based upon the selling price, which allows for a reasonable margin of profit on that selling price. If there is no check on the beater room, as to the amount and quality of the raw materials requisitioned from the stock room and used in each, furnish the manufacture of any given order of paper at a profit is indeed problematical to say the least, for the custom of the beater room crews to add a little more of the expensive fibres, just for luck, or to overcome some difficulty, will be too strong to resist and at inventory time, if there happens to be such a period, there will be a large discrepancy between the amount of expensive material on hand and the amount carried on the books.

This condition has been considerably improved in one mill by changing its methods of handling the raw materials, and charging directly against each order the actual amount of raw material used in its manufacture, thus accounting for every pound of material that leaves the stock room.

Formerly all the raw materials were weighed in by a receiving clerk and stored in the raw stock room in whatever happened to be the most convenient available space for the unloading crew, and from there on it was left to the tender mercies and discretion of the beater room crew. Naturally, the better grades of pulp, or the more convenient piles, were used up much more rapidly than the amounts called for in the formulas would lead one to expect.

Under the present system, a stock man is given complete charge and held strictly accountable for every pound of raw material used. The unloading and storing of the raw materials as they are received, is under his personal supervision. This insures that the various grades of material will be stored in such

A New Machine?

PERHAPS you, too, are now considering a new machine. Of course, you want a modern machine—one that will in plain words deliver the goods and put you on a fair basis with your present or future competitors. You can go a long way towards securing that type of machine by investigating and then including in the specifications those equipments that will insure the results you are after. One of the greatest developments now taking place in machine design is the application of SUCTION COUCH and SUCTION PRESS ROLLS, especially on high speed machines making news, kraft, etc. Some of the installations are unique in arrangement and the results are indicative of the important changes in machine design that will take place. You cannot afford to forego the investigation of this subject.

¶ And when making up your specifications do not fail to include such desirable improvements as SANDUSKY PATENTED SHOWER PIPES and FLUID COMPRESSED BRONZE PRESS ROLL JACKETS. After the machine is running you will appreciate the importance of this prudence.

Literature on Request

The Sandusky Foundry & Machine Company

Sandusky, Ohio

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WATERMARKED

Color Brilliant
Strength Wonderful

The HOWARD
Paper Company
Urbana, Ohio

WOLVERINE
Paper Company

"Wolverine"
Waxed Papers
for Every Requirement

Best Quality

Waxed Tissue a Specialty

OTSEGO, MICHIGAN

a manner as to give ready access to every grade carried in stock, and facilitate its removal to the beater room with the smallest amount of effort, also that the consumption of each lot will be in the order of its arrival, which prevents, to a large extent, the deterioration of the pulp through storage over too long a period.

Not one pound of raw material is permitted to leave the stock room without a requisition giving full information, such as job number, date, beater, quantity, etc., and countersigned by the superintendent. It is obvious that the new method has resulted in a considerable saving and that the paper now manufactured is according to formula. These are by no means the only benefits derived from the new system, and among the many meritorious innovations directly attributable to it is a comprehensive cost system, which is now being installed throughout the mill.

Coatings That Prevent End Checking

Wood, whether in the form of logs, lumber, timber, shaped blanks, or veneer, will split and check at the ends during seasoning, if drying is allowed to go on at a natural rate through the end grain. To retard the rate of drying from the ends, it is necessary to cover them with some protective coating.

The law of end coatings, in simple terms, is that the harder and greener the wood, the more effective must be the coating. In its experiments to determine the practicality of various coatings and end dips, the Forest Products Laboratory found the following to be true:

Paint is convenient to handle, but is of low effectiveness.

White lead is convenient to handle, and is of medium effectiveness.

Lorac, a commercial compound, is convenient to handle, and is of considerable effectiveness.

Rosin-lampblack is inconvenient to handle, but is of high effectiveness.

Rosin-lampblack is made according to the following formula:

Clear grade rosin, 60 parts by weight.

Lampblack, 1 part by weight.

The rosin should be melted but not allowed to boil or froth. The lampblack should then be thoroughly stirred in. The ends of the sticks should be dipped in this molten mixture to a distance of about ½ inch. When hard the coating should be smooth, free from bubbles, shiny, and an eighth of an inch thick over the end.

If the stock is to be subjected to rough handling which might cause the coating to chip when cool, linseed oil may be added, in the proportion of 1 to 15 by weight, but this will have a tendency to make the coating excessively soft in the kiln at temperatures above 130° F.

The Name
"HAMILTON"

HAMILTON engines and machinery are made by an organization that dates back 75 years. For half that time Hamilton Corliss engines have been spreading over the world in growing numbers, till now there are thousands supplying power in every industry.

A variety of specially designed engines bear the name Hamilton, as for instance those in the power plant of the Ford factory, aggregating some 60,000 horse-power. Blowing engines and rolling-mill machinery for the steel industry form an important branch of Hamilton production. Sugar cane grinding and crushing machinery of Hamilton design and construction is establishing new extraction records in Cuba.

HAMILTON
ENGINES *and* MACHINERY

For some two years every effort was concentrated on the production of Hamilton Marine engines for the U. S. Shipping Board. New methods of standardized production, disregard of outworn precedent, and a devoted personnel made it possible to put out complete 2800 horse-power marine engines at the undreamed-of rate of four a week.

The equipment of the plant where Hamilton engines are made is complete, modern, and well balanced; it includes probably the finest and largest outfit of heavy machine tools in the United States.

Hamilton engineers are in the front rank—each one a specialist of established reputation in his chosen field.

All this means that the name "Hamilton" stands for the utmost in design, efficiency, and endurance.

THE HOOVEN, OWENS, RENTSCHLER CO.
Hamilton, Ohio, U. S. A.

Largest producers in the world of highest grade Brimstone —guaranteed 99% pure—free of Arsenic and Selenium.

The
UNION SULPHUR COMPANY

In so far as possible we will be glad to offer advice or suggestions to prospective buyers who are using or may be contemplating the use of brimstone.

17 BATTERY PLACE
NEW YORK

Appleton

Felts and Jackets

Manufactured By

APPLETON WOOLEN MILLS

APPLETON, WIS.

News Items

Mr. Henry P. Thompson, Cincinnati, Ohio, a district representative of the American Steam Conveyor Corporation, Chicago, has added to his sales engineering staff, Mr. Albert A. Casey, who will push the sale of the American Steam Jet Conveyor in that territory. Mr. Casey is a mechanical engineer, a graduate of the Ohio State University and a valuable addition to Mr. Thompson's sales organization.

The Hooven, Owens, Rentschler Company, of Hamilton, Ohio, have opened two new offices and have made one or two changes in the personnel of their other offices.

A new office has been opened in Philadelphia, and Mr. C. M. Decker, formerly with R. D. Wood Company, has been made manager. The office is located at 2129 Land Title Building.

A new office has also been opened at Richmond, Va., with Mr. E. H. Fairchild, formerly of the C. & G. Cooper Company, in charge.

Mr. E. S. Cooley, formerly with the Fall River Ship Building Company, is now connected with the New York office of the Hooven, Owens, Rentschler Company.

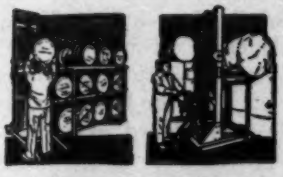
Mr. Henry E. Balsley, formerly with the American Bridge Company, has been made manager of the Chicago office.

Mr. R. C. Holman, formerly with the General Electric Company, centrifugal department, is now associated with the Hooven, Owens, Rentschler Company, in charge of all brewing engines.

Martin Spinelli Opens Office in Springfield, Mass.

The necessity of having representation in paper manufacturing centers is becoming generally recognized by dealers in papermakers' supplies and it is getting to be quite the custom for New York concerns handling paper manufacturing materials to establish branch offices in New England. The latest to take this step is Martin Spinelli, of 132 Nassau Street, New York City, dealer in papermakers' supplies of various descriptions, who has just opened a branch office in the Commercial Trust Building, Springfield, Mass., in charge of Morris G. Tuck, well-known in the cotton rag trade through his previous connection with Jaffe & Co., of New York.

It is the intention of Mr. Spinelli to broaden the scope of his business through the medium of new cotton cuttings, and his branch office in Springfield, in the heart of the writing mill district of New England, will afford proper facilities to enable him to quickly and satisfactorily fill all the raw material requirements of paper manufacturers in that part of the country.



Storing Barrels — Piling Roll Paper

SAFETY FIRST

ECONOMY ENGINEERING CO. CHICAGO U.S.A.

Piling Boxes — Piling Bales

What It Means to You

The above circular design, affixed to every Economy Tiering Machine, is not a warning. It is both a means of identification and a guarantee of freedom from possibility of accident.

Large packages lifted overhead by hand sometimes fell and injured workmen, or damaged merchandise, regardless of the number of men in the crew. So the Economy Tiering Machine was built not only to reduce labor and save space but to provide **absolute safety** as well.

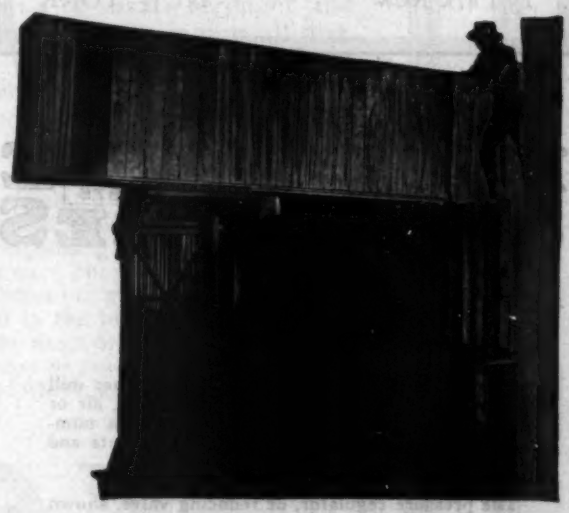
One man lifts the heaviest packages to the very ceiling, if he wishes, and places them upon a pile without danger of the machine tipping or skidding out from under the load Exclusive Economy features guarantee this.

Imitations with so-called improved features sometimes fall over with wide loads. But no Economy machine has ever been known to do so.

Our new book, "Saving Wasted Millions," soon to be completed, explains the Economy features. Write for a free copy.

Economy Storage Engineers may be consulted without charge on any storage handling question pertaining to your business. We invite correspondence.

ECONOMY ENGINEERING COMPANY
2635 West Van Buren Street, Chicago, U. S. A.
NEW YORK PHILADELPHIA ATLANTA DETROIT SAN FRANCISCO
Standard Steel Construction Co., Canadian Manufacturers and Selling Agents, Port Robinson, Ontario



One Man Handling Large Heavy Case With Utmost Safety to Self and Package

Note how one man is handling this 750-lb. crate containing a soda fountain counter. The machine is used without any extra braces or supports — yet it stands in perfect balance under the load.

Before this machine was installed five men were needed for this same work.

ECONOMY SYSTEM of STORAGE HANDLING

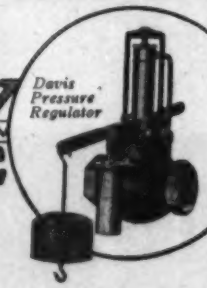
CASEIN

Standard Quality
Lowest Prices

For Early or Later Deliveries

THE CASEIN MANUFACTURING COMPANY

15 Park Row NEW YORK



DAVIS VALVE SPECIALTIES

STEAM SAVERS SINCE 1875

Davis Valve Specialties include many paper mill necessities—pressure regulators for steam, air or water, steam traps, balanced valves and a number of other steam savers for power plants and steam users.

The pressure regulator, or reducing valve, shown above is very simple in operation. It cannot get out of order or cause trouble. There are no springs and no diaphragms to break. Operation is controlled by gravity—and the Davis Pressure Regulator is as dependable as the force of gravity.

Other Davis valve equipment for paper mills is just as simple—and just as dependable. Every paper man should have a copy of the Davis engineering catalog. For your free copy, just address the G. M. Davis Regulator Co., 414 Milwaukee Ave., Chicago. Branches in principal cities.

DAVIS VALVE
STEAM SAVERS SINCE 1875
SPECIALTIES

L. B. Stewart, who for several years has held the position as secretary-treasurer of the American Paper & Pulp Association, has resigned to accept the position as sales manager of Shuttleworth, Kieller & Co., of 474 West Broadway, New York City. The change is to be made on February 2, 1920. Mr. Stewart has become one of the best known figures in the paper industry in America through the position as secretary of this big association, and more particularly through his work with the Pulp & Paper Division of the War Industries Board during the war.

The firm that he goes with has connections in many cities, that is aside from New York, at several points they have places of business in Brooklyn, Philadelphia, Jamaica, L. I., Stamford, Danbury and Waterbury, Conn., Berlin, Md., etc.

Mr. Stewart comes from a paper making family, and has held many important positions of trust before becoming secretary of the association, among which were the General Paper Company, a sales agency for mills with headquarters in Chicago, general manager of the W. D. Boyce Paper Mills, Marseilles, Ill., now one of the mills of the Certain-teed Products Corporation, general manager of the Munising Paper Company, Munising, Mich., and later general manager of the St. Regis Paper Co., Watertown, N. Y.

The Odell Poultry Supply Corporation, of Decatur, Ill., which owns and controls certain patents on improved types of egg containers, parcel post packages, egg cartons and a new type of packing board, has been organized with a capital stock of $700,000, and expects to build a board mill and factory to manufacture these articles.

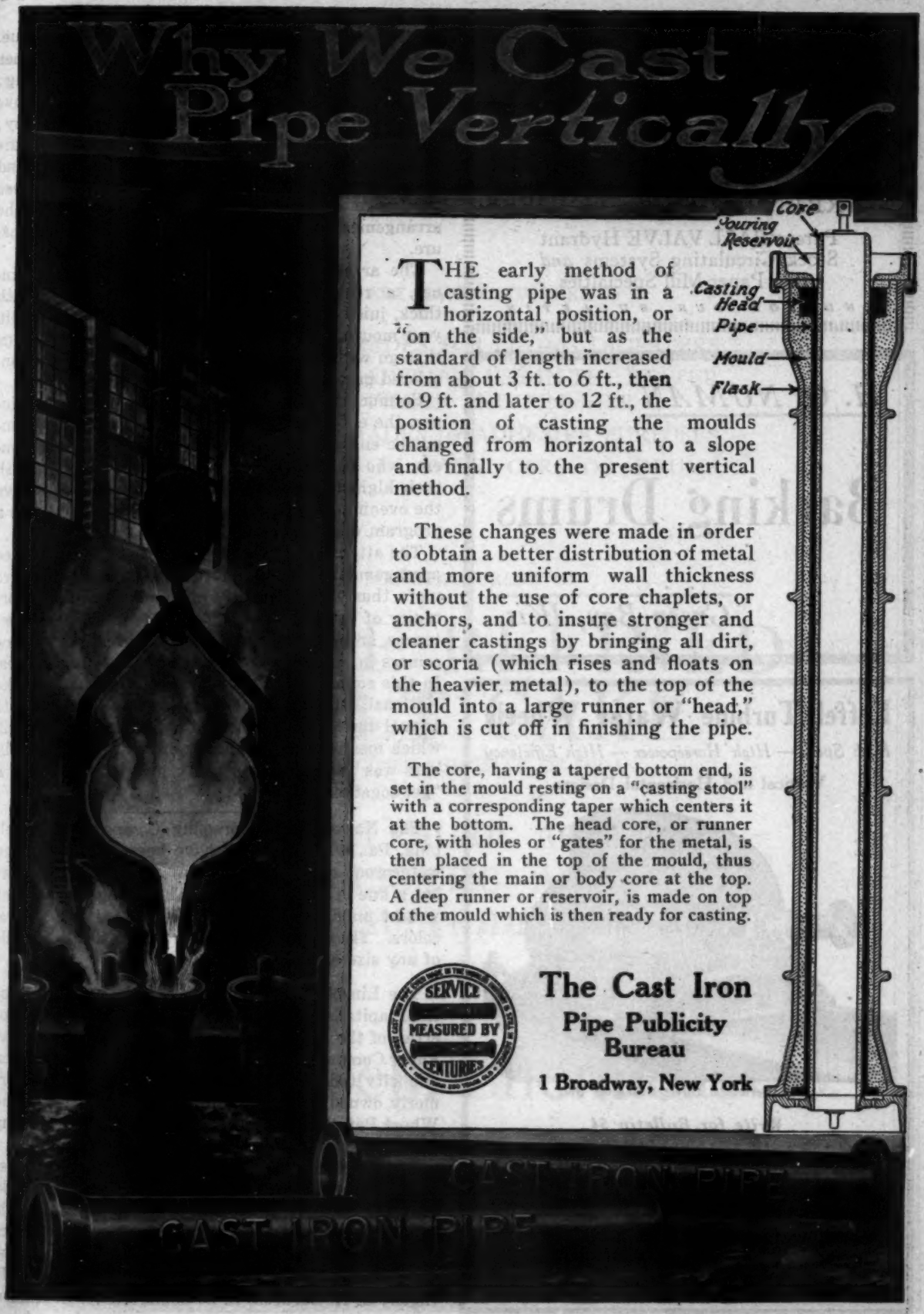
A gentleman was in our office some days ago and gave us the information that he, with others, would soon make arrangements to build a 100-ton board mill in Pittsburgh, to manufacture board and shipping cases from the board.

Arthur Bennett, formerly manager of the Western Board & Paper Co.'s mill at Kalamazoo, Mich., has resigned this position to go with the C. L. LaBoiteaux Co., of Cincinnati. Winship Hodge, who from the time he returned from the service up to the present, has been the purchasing agent for the Kalamazoo Paper Company, and who is a son of Fred M. Hodge, president of this company, will take the management of the western mill.

Paper Men Get Together Again

The New York Paper Jobbers' Association reestablished their old-time annual meeting and the committee's hard work made this dinner a record-breaker. The date was January 8th and the place, that well-known restaurant in the up-town section,

Why We Cast Pipe Vertically



THE early method of casting pipe was in a horizontal position, or "on the side," but as the standard of length increased from about 3 ft. to 6 ft., then to 9 ft. and later to 12 ft., the position of casting the moulds changed from horizontal to a slope and finally to the present vertical method.

These changes were made in order to obtain a better distribution of metal and more uniform wall thickness without the use of core chaplets, or anchors, and to insure stronger and cleaner castings by bringing all dirt, or scoria (which rises and floats on the heavier metal), to the top of the mould into a large runner or "head," which is cut off in finishing the pipe.

The core, having a tapered bottom end, is set in the mould resting on a "casting stool" with a corresponding taper which centers it at the bottom. The head core, or runner core, with holes or "gates" for the metal, is then placed in the top of the mould, thus centering the main or body core at the top. A deep runner or reservoir, is made on top of the mould which is then ready for casting.

SERVICE MEASURED BY CENTURIES

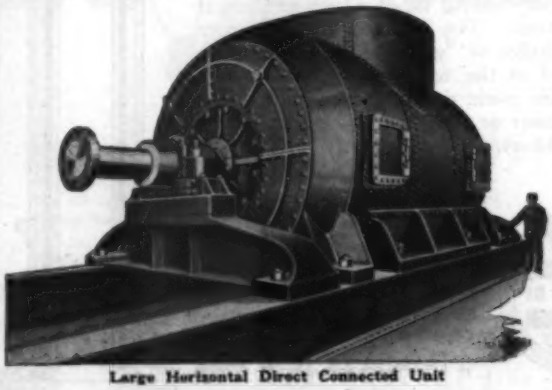
The Cast Iron Pipe Publicity Bureau

1 Broadway, New York

Ticonderoga Machine Works
TICONDEROGA, N. Y., U. S. A.
MANUFACTURERS OF
WARREN IMPROVED CALENDER DOCTORS
With Flexible Blades, Universal Adjustment and Control
(PATENTED)
WARREN IMPROVED PATENT DOUBLE DRUM WINDERS
Patent BALL VALVE Hydrant
Stock Circulating Systems *and*
other Paper Mill Specialties
SEND FOR OUR BULLETIN

H. O. NUMAN
Barking Drums
Green Bay, Wis.

Leffel Turbine Water Wheels
High Speed — High Horsepower — High Efficiency
Vertical and Horizontal Designs



Large Horizontal Direct Connected Unit

Write for Bulletin 54

***The* JAMES LEFFEL & CO.**
SPRINGFIELD, OHIO

SALES ENGINEERS
B. F. Groff, 558 Woolworth Bldg., Lancaster, Pa.
L. B. Dow, Inc., 79 Milk Street, Boston, Mass.
H. H. White, 1203 Fourth Nat'l Bank Bldg., Atlanta, Ga.
William Hamilton Co., Ltd., Peterboro, Ont., Canada.

Thomas Healy's, at 66th street and Columbia avenue.

The committee which was in charge of the dinner arrangements was composed of the following: Arthur B. Murtha, of the Harper Paper Company; H. A. Earle, of the Whiting-Patterson Company; Fred H. Ross, of the Bishop Paper Company; Louis Schuman, of the Manhattan Card & Paper Co., and Michael Milton, of the Milton Paper Company. These men gave considerable time and thought to the arrangements for a full evening of unmarred pleasure.

The arrangements consisted of a beefsteak dinner, a real old-fashioned beefsteak dinner, with thick, juicy beefsteak, the kind that almost melts in your mouth, and plenty of it, and all the other things that go with a beefsteak dinner and have been considered part of it from time immemorial.

So much for the dinner. While it was some dinner, the entertainment was just as good. The committee engaged the regular Golden Glades performers, who nightly amuse hundreds at Healy's with their high-class cabaret. These talented artists gave the evening over to the paper men and it sure was a program of unusual merit.

The attendance was very large and the committee arrangements for extensive accommodations were more than appreciated. Paper men had an opportunity of getting together, of renewing old acquaintances and making new ones, of greeting to new comers in the trade and hailing the old-time figures. In this connection it should be pointed out that the National Paper Trade Association had postponed its annual dinner, usually held in the winter, until April, which means that this dinner of the New York jobbers was the first opportunity in a long time for a "get-together."

The National Waterproofing Company, Philadelphia, Pa., who for years have been manufacturing waterproof case lining, are now putting on the market a line of waxed papers. They range from light weight manilla, fiber and sulphate kraft, in several colors. They can furnish these papers either in rolls of any size or in sheets.

The Lincoln Paper Mills, a new Indiana corporation, capitalized at $500,000, has purchased the properties of the Elkhart Paper Company and the Wheat Paper Company, according to an announcement given publicity today. The Elkhart Paper Company formerly owned the real estate and improvements, the Wheat Paper Company being the operating company only.

The Lincoln Paper Mills was organized on August 30th last. The stock is owned by residents of Elkhart, Kalamazoo, Detroit and South Haven, Mich. According to the articles of incorporation, the officers are: President, Edward B. Zigler; secretary-treasurer, Harry A. Bardeen. The directors are, E. B. Zigler, H. A. Bardeen, E. B. Connable, W. E. Kidder,

Silicate of Soda

WE ARE MANUFACTURERS OF

SPECIAL GRADES FOR LINING DIGESTERS
SPECIAL GRADES FOR USE IN THE BEATER AS A FILLER AND FINISHER
SPECIAL GRADES *for* ADHESIVE PURPOSES
SHIPMENTS IN TANK CARS OR DRUMS

MANUFACTURERS OF

PRIME REFINED SALT CAKE

(CALCINED SULPHATE OF SODA)

SULPHURIC ACID
MURIATIC ACID
SODIUM SULPHIDE—*All varieties*

The Grasselli Chemical Co.

CLEVELAND
CHICAGO CINCINNATI NEW YORK
MILWAUKEE ST. LOUIS BIRMINGHAM
ST. PAUL DETROIT NEW ORLEANS
PITTSBURGH

30 Years Exporting American Paper

Our Markets: The World outside of U. S. A. and Canada.

Our Organization: Ten selling offices, besides salaried travelers and local representatives.

Our Demand: An established clientele, constantly being increased, by an aggressive sales policy.

Our Supply: Your Mill?

Present conditions in America are temporary.

Have you considered what a first-class export outlet would mean to you, with its assurance of steady demand?

Parsons Trading Company

17 Battery Place
NEW YORK

London, Stockholm, Sydney, Melbourne, Wellington, Bombay, Mexico, D. F., Havana, Buenos Aires, Rio de Janeiro

Besides traveling salesmen and local representatives at many other places.

H. B. Hoyt, H. L. Vander Horst, B. Hopper, A. G. Gilman and S. B. Monroe.

The plant is equipped with three Fourdrinier machines, which trim a maximum of 70, 80 and 90 inches. The supercalenders handle sheets 80 inches wide. In addition to this equipment there are ten washers and two rotary boilers, six 1,200-pound heaters and three Jordan engines. The steam plant is one of very modern construction, consisting of four 300 h. p. Wickes boilers, one 1,700 h. p. Allis-Chalmers turbine which runs at the rate of 3,700 r. p. m. In addition are two auxiliary engines of 300 h. p. each.

Mr. E. B. Zigler, head of the new enterprise, needs no introduction to Elkhartans, being one of the city's leading attorneys and also being identified with many of our most successful industries.

Mr. Bardeen, general manager, was formerly with the Bardeen Paper Company at Otsego, Mich., and is very well and favorably known among the paper trade generally.

The National Aniline & Chemical Co., Inc., 21 Burling Slip, has recently issued an attractive color card showing samples of paper dyed with those of their products which are especially applicable to paper. Forty-two shades are shown comprising acid colors, of good fastness to light, generally used for coloring sized paper: basic colors, possessing great tinctorial power for pure vegetable fibres, and for the production of mottled effects with mixed stock, and direct colors for use with unsized pulp, in the manufacture of blotting and copying paper.

General information as to the use of these colors is given, and the card provides a valuable addition to the resources in the use of American colors available for our paper manufacturers and lends to the term, "National Colors," a new significance.

That the powerful financial interests responsible for the incorporation of the Hercules Paper Corporation intend to make the corporation a tremendous factor in the production of paper in America on a specialized service basis, is evidenced by the fact that on Friday, December 19th, they made a most important acquisition by purchasing the controlling interest of the Frank Gilbert Paper Company, Waterford, N. Y., from its president, H. I. Prankard. This company is one of the oldest producers of paper in America and operates three mills consisting of a paper mill in Waterford, N. Y., a pulp mill in Cohoes, N. Y., and their recently erected large paper mill in Cohoes, N. Y., rated to be one of the best and most complete plants in the country. This company has long borne an enviable reputation in the trade for the perfection of its product, the diversity of its papers and its location which permits quick deliveries to the important markets.

Messrs. Blake & Decker, Inc., announce the estab-

THE WORLD'S BEST FILLER

ASBESTINE PULP

(Reg. U. S. Pat. Office)

Finest White Color Natural Fiber Retention 90%

Every Way Superior to Clay

Prompt Shipments Guaranteed—Largest Mills in the World

INTERNATIONAL PULP CO., 41 Park Row, New York

RUSS GELATIN CO.

Factory—WESTFIELD, MASS.

MANUFACTURERS OF

GELATIN and GLUE

ANIMAL SIZING GLUE STOCK

LARGEST SPECIALISTS IN AMERICA ON

FINE WRITING PAPER SIZING

E. F. RUSS COMPANY 201 Devonshire St. BOSTON, U. S. A.

James L. Carey

Paper Mill Architect and Engineer

208 N. Laramie Ave., Chicago, Ill.

GRAVER *Corporation*

(WM. GRAVER TANK WORKS — FOUNDED 1857)

Steel Tanks and General Steel Plate Construction
Water Softening and Purifying Equipment

East Chicago, Indiana

PAPER MILLS

WE have a selling capacity twice our supply, and are in the market for paper in large volume, and would like to hear from you.

Our competent selling organization has from the beginning always demanded an ever increasing supply. We are at present all sold up and looking around for more, and are now in the market for five thousand tons in several grades.

We would be glad to hear from you what tonnage you can give us during this year. Write us.

Interstate Pulp & Paper Co., Inc.
Grand Central Terminal, New York City

BOLTON QUALITY

CHIPPER KNIVES BARKER KNIVES BEATER KNIVES BEATER PLATES

REMEMBER

BOLTON QUALITY

When it is a matter of

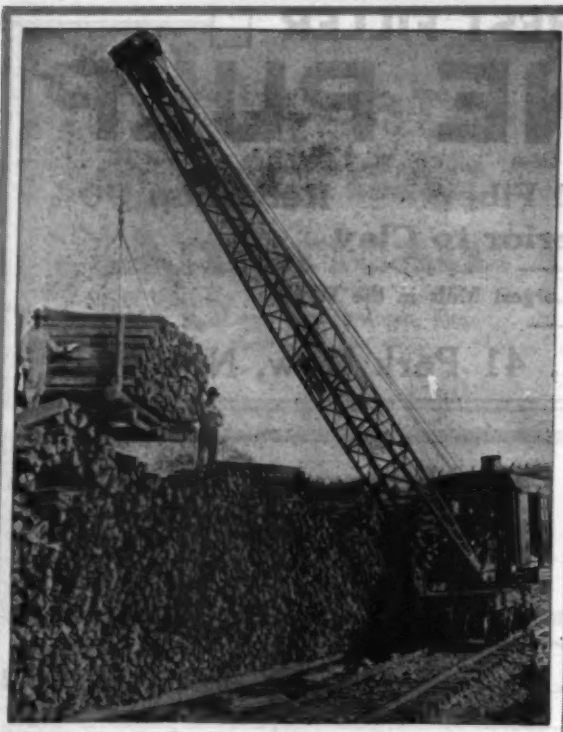
Barker Knives
Beater Bed Plates
Beater Fly Bars
Chipper Knives
Jordan Engine Fillings
Paper Trimming Knives
Rag Cutter Knives
Rotary Cutter Knives

Of every description used in Paper and Pulp Mills

¶ Designed to meet specific needs and of uniformly High Grade.

John W. Bolton & Sons, Inc.
LAWRENCE, MASS.

JORDAN FILLING



Handling Materials at the Mill

IS YOURS one of the many mills which handles considerable pulp? Some of these have found it to be more rapid and economical to do this handling with a Brownhoist locomotive crane. A Brownhoist will not only place the pulp wherever it is needed, but will handle your coal, switch the cars and take care of innumerable jobs which come up around the yard. If you have much handling to do, our long crane experience should be of use to you. We will gladly give you any information for the asking.

The
Brown Hoisting Machinery Co.
CLEVELAND, OHIO, U.S.A.

Engineers and Manufacturers of Heavy Dock Machinery Bridge Cranes, etc., as well as smaller Cranes and Hoists

Branch Offices in New York, Pittsburgh, Chicago and San Francisco.

lishment of their Boston office in the John Hancock Building, 49 Federal Street, for the transaction of a general paper business, under the management of Mr. Harold C. Livermore, for the past five years connected with Dill & Collins Co. His experience, in addition to our established manufacturing connections, enable us to extend a most valuable service in the supply of paper to printers and publishers. We will value a trial by you of that service.

Comparative Durability of Green and Seasoned Timber

Opinions of wood users have always differed as to the comparative durability of untreated green and seasoned timbers when used for poles, posts, or ties. Recent experiments conducted by the Forest Products Laboratory indicate that there is practically no difference in the relative durability of untreated green and seasoned timbers when exposed to the weather and in contact with the ground.

The following service records of ties laid by the laboratory in co-operation with the Northern Pacific Railway bear out this conclusion:

Life of Green and Seasoned Ties

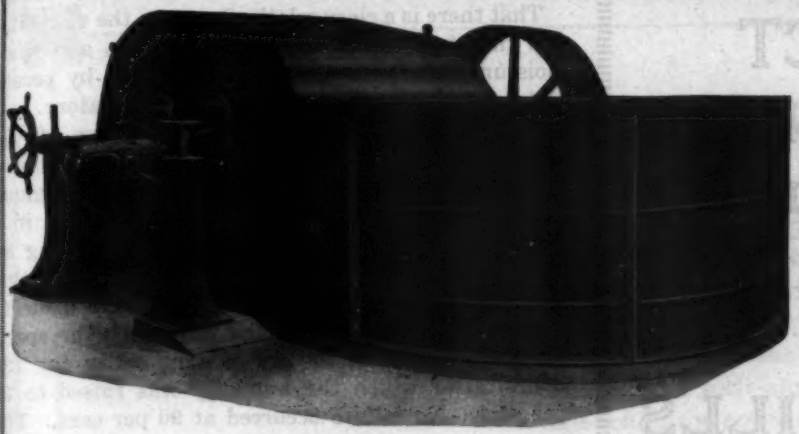
Place	Species	Green or Seasoned	Average life in years
Maywood, Washington	Douglas Fir	Green	7.7
	Douglas Fir	Seasoned	7.8
Plains, Montana	Douglas Fir	Green	7.6
	Douglas Fir	Seasoned	7.7
	Western larch	Green	7.3
	Western larch	Seasoned	7.4

In each of these cases the average life of seasoned ties was only one-tenth of a year longer than that of the green ties. This difference is obviously so slight as to be negligible.

Periodical measurements on poles made by the laboratory in co-operation with the American Telephone and Telegraph Company show that the rate of decay in green poles is a trifle less than in seasoned poles.

The fact that green and seasoned timber have the same durability when used in exposed places is easily explained. Moisture content is the principal factor in determining the rate of decay of a stick of timber. As soon as the timber is placed it begins to take up or give off moisture, according to its condition of seasoning and the conditions of exposure. Within a relatively short time in exposed construction both green and seasoned timber reach the same moisture content.

When used in buildings, however, wood does not usually dry out rapidly after being placed. Wood for interior construction must be seasoned before use; otherwise, it is likely not only to shrink to a serious extent but also to decay before it seasons. Very expensive building repairs have been necessitated by the use of green timber.



DILTS BEATING ENGINES ARE USED AROUND THE WORLD

DILTS MACHINE WORKS, Inc.

FULTON, NEW YORK, U. S. A.

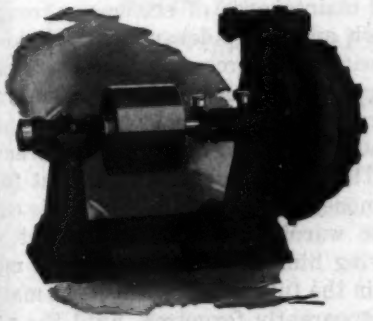
Manufacturers of

Beating and Washing Engines, Fly Bars, Bed Plates, Rag, Chipper and Cutter Knives, etc.

AMERICAN-MARSH

Centrifugal Pumps

BELT OR MOTOR DRIVEN

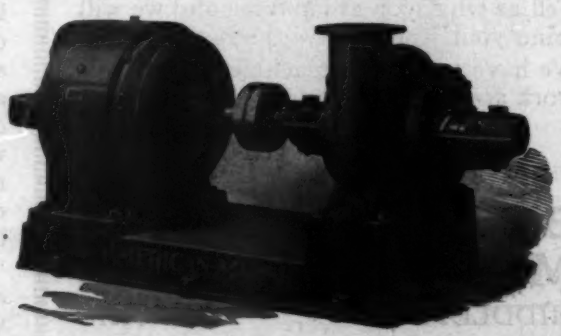


Extra wide ring oiled bearings. Overhanging casing allowing the discharge to be taken at any angle desired. Removable outer head so that impeller may be withdrawn without disturbing the casing. Hydraulically balanced impeller insuring minimum end thrust. Impeller machined all over and turned to make a close running fit with the casing.

Finished with open runner for handling paper stock.

INVESTIGATE. ASK FOR BULLETIN No. 25.
Furnished Promptly Upon Request.

We Also Manufacture **Power Pumps, Deep Well Pumps, Boiler Feed Pumps, Vacuum Pumps, Horizontal Power Air Compressors.**



American Steam Pump Co.

Battle Creek, Michigan

Chicago Office, 1220 Monadnock Block.
New York Office, Whitehall Building, 17 Battery Place.

PERFECT ROLL GRINDING

of **Calender Rolls Brass Rolls and Rubber Covered Rolls** *for*

PAPER MILLS

is an impossibility except to those who have had long experience in this work. We are not only specialists in Roll Grinding, but we

Absolutely Guarantee Perfect Work

Tell us what you are making and we will grind your Rolls to give the Best Results. We have two large machines doing this work and can give you Service.

SEND FOR LIST OF SATISFIED PAPER MANUFACTURERS

BEVIS & SHARTLE MACHINE CO.

MIDDLETOWN OHIO

Resistance of Animal Glues to Moist Air

That there is a close relation between the viscosity, and therefore the grade of animal glues and their moisture resistance is strongly indicated by recent tests made at the Forest Products Laboratory.

Test specimens were made of two pieces of 1/8" birch veneer glued together with the grain in opposite directions so as to give 1 square inch of glued joint surface. The specimens were suspended in a humidity chamber with a 1-pound weight hung on each, and the time required for failure of the glue joint was noted. The first two tests were made at 98 per cent humidity. In the third test, the specimens were kept at 90 per cent humidity for 120 hours, after which the humidity was raised to 98 per cent. No failure occurred at 90 per cent. The temperature used in each test was about 80° F.

Resistance of Glues of Different Viscosity to Moist Air

Glue Used			Test No. 1		Test No. 2		Test No. 3	
No.	Relative viscosity (Engler)	Jelly strength by Smith tester	No. specimens used	Av. No. hours before failure	No. specimens used	Av. No. hours before failure	No. specimens used	Av. No. hours before failure†
13	1.62	222	2	10½	4	12	4	24
7*	...	...	.	..	4	12	4	24
36	1.70	219	2	12 1-7	4	14½	4	24
37	1.92	256	2	13	.	..	4	44
34	2.00	267	2	17	4	26½	4	48
35	2.90	315	2	42	4	36	.	..
19	4.98	356	4	59½	.	..	.	..
21	4.14	338	.	..	4	48	4	66
9	5.48	416	.	..	4	66½	4	198

* A vegetable glue.
† After raising humidity to 98 per cent.

The results indicate that the moisture resistance of animal glues is proportional to the viscosity, jelly strength, and grade.

Keep Them Informed

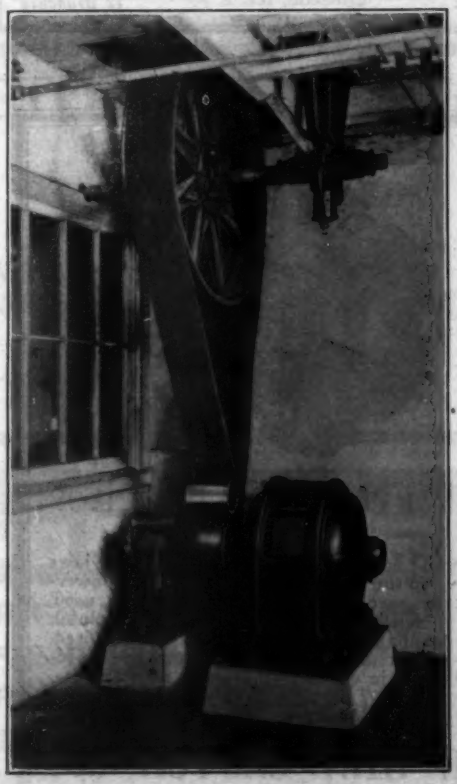
To insure the maintenance of efficiency throughout the mill, each and every department should be kept in touch with the percentage output, waste, cleanliness and general efficiency. Perhaps an order of paper is returned to the beater, owing to the negligence of a machine tender, beater room foreman or color man. The attention of the person at fault is called to the money and time loss, due to his carelessness and the warning given that it must not occur again, giving him strict charge that he must be more careful in the future, after which the matter is dropped and apparently forgotten, until the next occurrence. But if the figures are put down in black and white and placed in a position where the offender and everyone in his department can easily see and comprehend them, the results achieved will be well worth while, and will bring the units in each department in much closer and more personal contact with one another, developing an esprit de corps that will be of inestimable value.

While this plan of drawing up reports on the efficiency of each department that will show up the individual units will entail some additional clerical work, it will more than pay for itself by increasing the

The LENIX Drive

¶ THE LENIX is a mechanical device scientifically applied to belt drives for the purpose of giving large arcs of contact between belt and pulleys, and automatically increasing or decreasing from such arcs in proportion to the variation in the power transmitted,

¶ THE LENIX prevents slippage yet permits of the elimination of 75 per cent of the initial tension universally found in belt drives. It gives absolute freedom in the relative location of the shafts and the ratio between the size of the pulleys. It saves in floor space, belting and power.



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F. L. Smidth & Co.
Engineers
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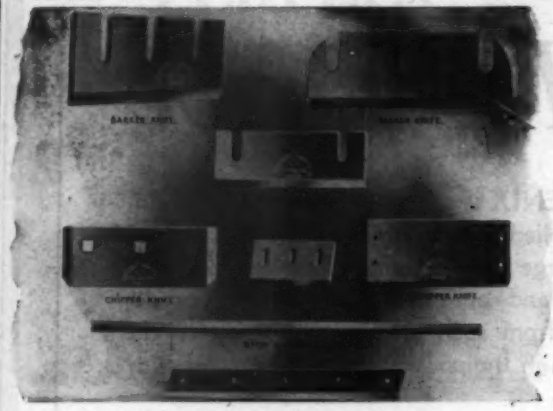

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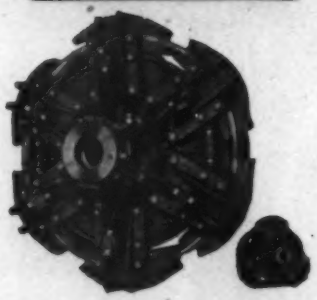

Hill Friction Clutches

(SMITH TYPE)

¶The most powerful clutch built. Vise-like jaws in pairs grip the ring, and are actuated by a powerful toggle mechanism. No springs are used. Clutch is self-centering, and in a friction clutch cut-off coupling no alignment bushing is required, so that when clutch is disengaged there are no revolving parts in contact—therefore, no wear

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CLEVELAND, OHIO

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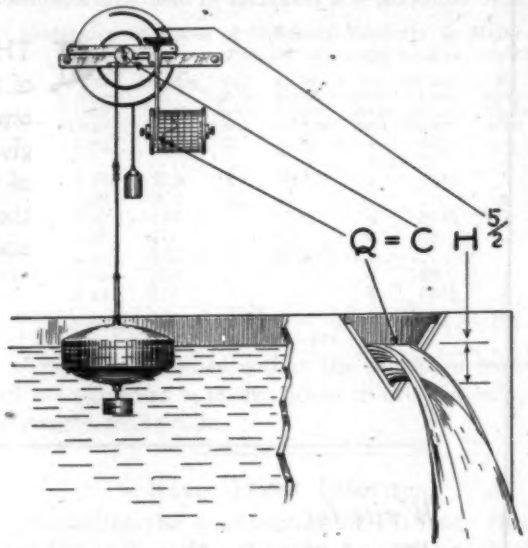
quality of work and decreasing the amount of broke. It will be a constant reminder that care must be exercised in conducting the work and a full report of each and every instance of excessive broke or waste will in a large measure prevent the recurrence of that particular trouble.

Measuring Boiler Feed Water and Other Liquids

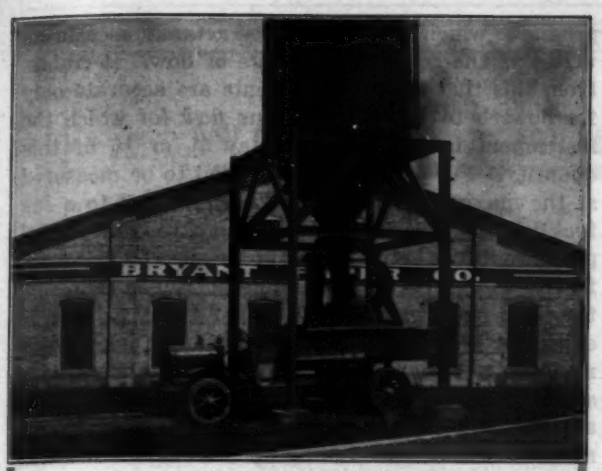
Quantitative information is the basis of modern industrial processes. It is necessary to know how much water is fed to a boiler and how much coal is burned on the grate in order to know whether the coal is being used economically. The condensed returns from heating and drying systems should be measured in order to know how much steam should



be charged against them. It is likewise often useful to determine by measurement the rate of flow of chemical solutions, etc.

The principal methods for measuring liquids are: Volumetric measurements, gravimetric measurements, measurements of differential pressure due to flow through constricted orifices, venturi tubes, or aganist Pitot tubes, and finally measurements of head upon orifices, notches, or weirs where the liquid has a free surface.

The volumetric and gravimetric methods offers good accuracy, and are useful where the flow does not need to be continuous. With the Cochrane precison meter, for example, which uses the volumetric method, an accuracy within 1 per cent is readily obtained. Where the liquid must flow in a continuous stream, however, either the Pitot tube, orifice, or venturi tube, or the weir methods must be employed. The venturi tube, orifice, and Pitot tube offer convenient and readily applied means for measuring liquids flowing in closed pipes under pressure. They have the disadvantage, however, that the differential



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Saving Labor While Handling Ashes

The Bryant Paper Company, Kalamazoo, Michigan, uses the American Steam Ash Conveyor in their boiler plants because it saves labor. Their Ash Disposal costs were reduced to a marked extent and ash wheelers were put to productive work.

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ON his little journey through the mill, Bert picked up a hunk of the stuff we use to wax our paper and of course we told him it came from India, because we wanted a wax that was slow to be influenced by heat—that would keep molasses kisses and lolly-pops and fine candies in elegant shape even when the sun boils hot.

The de lux book Cy has finished for us is full of pointed things, observed by E. H. the Second, who wrote most of it for us. Right gladly will we mail you a copy—if you speak up in a letter.

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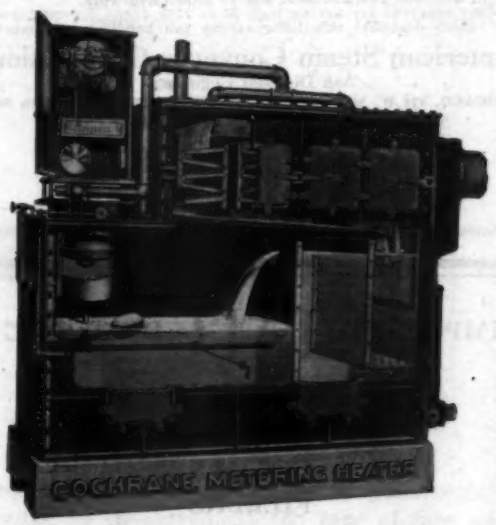
pressure, which is the quantity actually measured, varies as the square of the rate of flow. It results from this that the measurements are accurate only for flows between the maximum flow for which the instrument is designed, and say ⅓ or ½ of this quantity. For example, if the head to be measured at the maximum rate of flow is equivalent to a one foot column of water, at ½ capacity, the differential pressure will be only ¼ ft. of water and at 25 per cent flow it will be only $\frac{1}{16}$ ft., while at 10 per cent flow the head to be measured is only 1/100 ft., and it is expecting a great deal of an instrument designed to measure a 1 ft. water column, that it should with satisfactory accuracy measure a one-hundredth of a foot water column, particularly if the instrument must transcribe the reading upon a chart which has equal devisions for equal increments in the rate of flow. To do this necessitates the use of some kind of cam, necessarily involving friction. Although the friction of the cam and other parts may be incon-



siderable at rate of flow near the maximum, it becomes serious at the smaller flows. The difficulty is obviously increased if the differential pressure measuring device must also operate an integrating or totalizing instrument, which requires to be moved equal distances for equal changes in the rates of flow, at all points within the total range of flow.

When we take up orifices or weirs where there is a free water surface, the plain orifice, either submerged or discharging into free air, presents the same difficulty, that is, the head to be measured at small flows is inconsiderable in comparison to the head to be measured at maximum flow.

The rectangular weir, as represented either by the weir with full end contractions or the Bazin weir with end contractions suppressed, is somewhat better in this respect, since the flow varies very nearly as the head multiplied by the square root of the head, or in other words, as three-half power of the head. A difficulty with this type of weir, however, is that so

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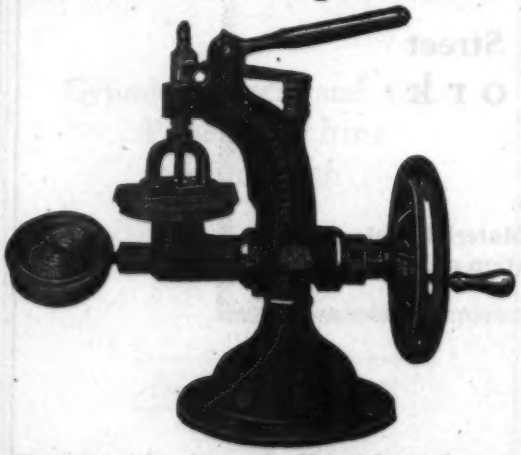

The Adopted Standard of the United States Government, the Freight Classification Committees and the General Paper Trade.

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Registers the breaking strength in actual pounds per square inch, not in a mere arbitrary scale. Made in various sizes to test all grades of paper goods from the lightest tissues to the heaviest boxboards.

Send for Catalogue and References

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many variations are possible in the proportions of the weir that reliable coefficients to meet all variations are not available. There is also difficulty in measuring the flow when the head upon the weir is small, the sheet of discharged liquid being very thin and tending to cling to the down-stream surface of the weir. Furthermore, the exact formula of the rectangular weir is complicated, corrections being required according to the ratio of the head to width, which renders it impossible to provide a standardized cam or other device for converting head to flow in a recording and integrating instrument. The cam has to be especially made for each different weir.

The V-notch or, triangular weir has the advantage that the cross-section of the issuing stream is a similar figure at all heads. From this geometrical similarity it is to be expected that the conditions of flow will be similar, and that therefore the coefficient of the formula of discharge will be relatively constant. This formula as given in one of the illustration, states that the flow varies as the five half power of the head, that is, as the square of the head times the square root of the head. The first accurate investigation of the V-notch weir of which we have record was made by Professor James Thompson, a brother of Lord Kelvin, at Queens College, Belfast, some sixty years ago. From his experiments Professor Thompson obtained value for C varying from .3048 at 6 inches head to .3088 at 2 inches head, Q being the delivery in cubic feet per minute and H the head over the apex of a 90-degree notch in inches.

In 1910 an elaborate experimental investigation was carried out at Glasgow University by James Barr, who investigated not only the 90-degree notch placed in the wall of a channel of a great depth, width, and length, but also notches of smaller angles placed at the end of narrow and shallow channels. His results for the 90-degree notch with unrestricted approach are given in the following table:

Head in Inches	*Value of Coefficient C*	*Flow in Cubic Feet*
2	0.3104	1.755
2½	0.3084	3.045
3	0.3068	4.782
3½	0.3057	7.002
4	0.3047	9.750
4½	0.3038	13.05
5	0.3032	16.95
5½	0.3026	21.46
6	0.3021	26.63
6½	0.3017	32.49
7	0.3013	39.05
7½	0.3009	46.34
8	0.3006	54.06
8½	0.3003	62.92
9	0.3000	72.90
9½	0.2998	83.33
10	0.2995	94.70

In adapting the V-Notch weir to commercial uses it is mostly installed in weir chambers of quite limited dimensions, as in the combined open feed water heater and V-Notch meter shown herewith. This

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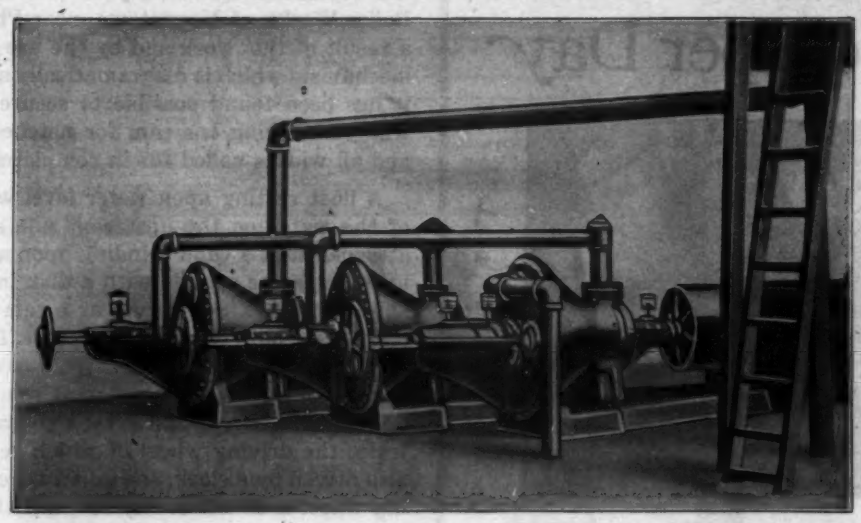

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A Paper Mill power plant reports that it has saved 36 men and 10 tons of coal per day since the installation of

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The management when awakened to the extravagance of the old plant immediately began to modernize their power generating equipment.

Since putting the new station into operation the Haverhill Boxboard Company of Haverhill, Mass., reports *"everything running in first-class manner, better than we could even hope; have effected* $52,000 *saving the first year —expect to exceed this figure next year.*

The Riley Stoker effects maximum saving in fuel and labor because it is the only Underfeed stoker that is automatic in all its functions. The reciprocating grates, the distinctive feature, not only greatly intensify combustion by increasing efficiency, but automatically break up clinkers and continuously discharge the refuse.

Send for the Riley Stoker catalog D-1. It will show you how to save fuel and labor, two of the most vital features in the operation of your plant.

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has necessitated comprehensive investigations concerning the influence of weir chamber dimensions upon the performance of the notch, as carried out at the Hydraulic Laboratory of the Harrison Safety Boiler Works, at Norristown, near Philadelphia. As a result of this work and by the use of the recorder mechanism which is diagramatically shown herewith, it has been found possible to secure good accuracy while employing one cam for notches of all heights and all widths called for in commercial applications.

A float resting upon water level with the surface of the water on the upstream side of the weir has attached to it a cable winding upon a drum mounted upon the same spindle with a disk in which is cut a spiral groove which serves as a cam to move a carriage horizontally equal distances for equal increments in the rate of flow. This carriage carries a pen which inscribes upon a chart wound upon a drum driven by a clock, and may also carry a counting train, the driving wheel of which rests upon a disk also driven by a clock, and so arranged that the driving wheel is at the center of the disk when the flow is zero. Inasmuch as it is desirable that the height of the chart and the travel of the counting train be the same for all types of notch, it is necessary to provide that different maximum float travels, as 4 and 10 inches for example, shall correspond to the same as pen travel, as 2½ inches. This is readily done, with the mechanism here illustrated, by changing the diameter of the drum upon which the float cable is wound.

In the complete recorder shown in the view of the Cochrane metering heater, both the chart drum and the integrator disk are driven by a single weight-operated pendulum clock, thus insuring synchronism between the chart drum and the integrator disk and also eliminating the necessity of winding, regulating and caring for two clocks. The heavy pendulum escapement is also found to be rugged and reliable under severe conditions of dust and moisture and indifferent care, which are so frequently encountered in the situations in which such apparatus must be installed.

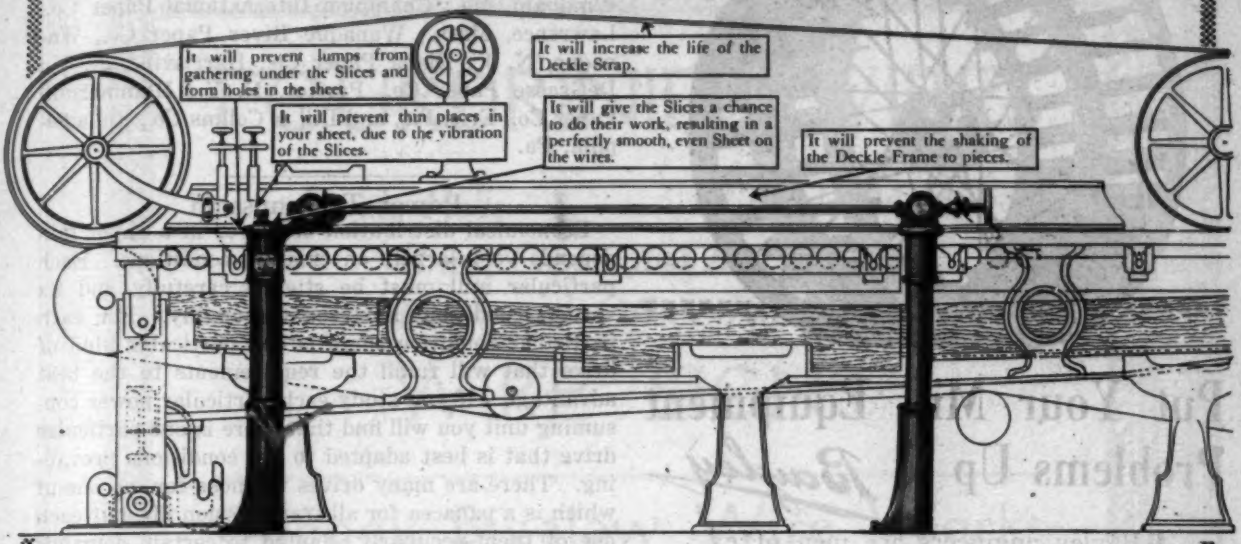
It has been found by numerous practical trials that the V-Notch meter with this recorder can be depended upon within less than 1½ per cent, which, in fact, is the guarantee regularly given by the manufacturer.

Many adaptations of the apparatus can be made. The V-Notch weir may be installed in a canal, or in a simple weir chamber placed close to a tank or funnel into which the measured fluid is discharged. Several V-Notch weirs can measure condensed returns from different sources, all discharging into a large meter which also receives make-up water and measures the total boiler feed.

Paper mills using these meters include the following: Eddy Paper Mill of Three Rivers, Mich.; Con-

The Acme Deckle Frame Support

"is indispensable to the making of Good paper"


It will prevent lumps from gathering under the Slices and form holes in the sheet.
It will prevent thin places in your sheet, due to the vibration of the Slices.
It will increase the life of the Deckle Strap.
It will give the Slices a chance to do their work, resulting in a perfectly smooth, even Sheet on the wires.
It will prevent the shaking of the Deckle Frame to pieces.

It will make better edge, save breaks and take less power.

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"Northern" Toilet Papers

"Northern" Inter-Folded Towels

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CAPACITY 100,000 LBS. PER DAY

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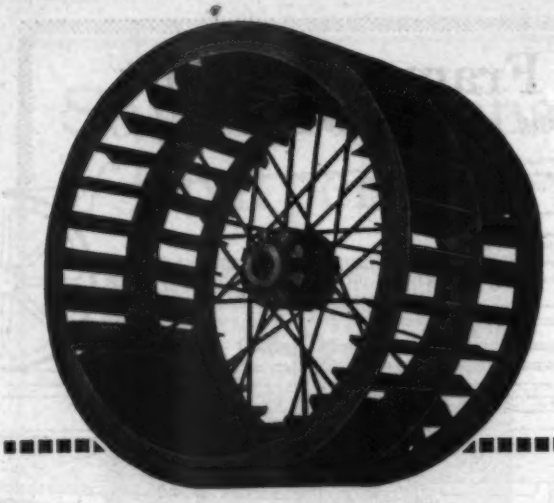

Put Your Mill Equipment Problems Up to *Bayley*

¶ Bayley engineers are men of extensive experience in coping with problems of industrial heating, ventilating, drying, cooling, dust and refuse disposal, etc. Much of this experience represents specific association with paper mill equipment and the special efficiency problems and installation requirements of the paper mill industry.

¶ These men are at your disposal any time you wish to consult them on mill equipment for your own individual needs. They will give you intelligent, judicious advice on any of these lines of equipment:

Forced and Induced Draft Systems; Pneumatic Chip and Ash Handling Systems; Cooling Systems for Electric Generators, and for Calendars; Absorption Systems; Forced Ventilating Systems; Dust Collecting Systems, etc.—all of which are numbered among the many successful applications of Bayley Equipment to paper mill needs.

¶ No new equipment plans in any of the above installations will be complete unless they include a post card or letter to

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732 Greenbush Street Milwaukee, Wis.
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tinental Paper Co., Bogota, N. J.; Lake Superior Pulp & Paper Co., Sault Ste. Marie, Ont.; Spanish River Pulp and Paper Co., Sturgeon Falls, Ont.; Illinois Paper Co., Peoria, Ill.; Androscoggin Pulp Co., So. Windham, Me.; Champion International Paper Co., Lawrence, Mass.; Wanaque River Paper Co., Wanaque, N. J.; Diana Paper Co., Harrisville, N. Y.; DeGrasse Paper Co., Pyrites, N. Y.; Hammermill Paper Co., Erie, Pa., and Dill & Collins Co., Philadelphia, Pa.

Power Transmission

Economical distribution of power in a paper mill depends very largely on existing conditions. Each particular mill must be studied carefully and its various conditions analyzed thoroughly. For each particular condition there is one particular kind of drive that will fulfill the requirements to the best advantage. If you study each particular power consuming unit you will find that there is one particular drive that is best adapted to the conditions prevailing. There are many drives to chose for, no one of which is a panacea for all transmission ills, but each one of them peculiarly adapted to certain demands and service, therefore in a paper mill, where the conditions of power are so varied, no one drive will give universal satisfaction.

A factory to manufacture thread from paper, and to weave cloth for the packing of their products, is in operation at Grenada, Spain. The raw material or paper pulp is obtained from eucalyptus wood, of which tree the company has a plantation covering many acres, which is being largely extended. The process is as follows: Paper is first made from the wood pulp and is then slit and rewound into small, narrow reels. Each reel is placed on a spinning wheel which is held in position by a needle that revolves with a velocity of 5,000 to 6,000 rev. per min. By this means the strip of paper is twisted and forms a kind of tube. To make it of greater resistance it is soaked in a special kind of insoluble glue. The materials obtained from this paper thread are still far too coarse to substitute for linen or cotton cloth.

The C. J. Foley Paper Co. was incorporated in the State of Illinois with a capitalization of $50,000, to conduct a general jobbing and mill order business.

Mr. C. J. Foley, the president of the new organization, has been connected with the Seaman Paper Co. for the last eleven years. He has associated with him in this enterprise as secretary-treasurer Mr. H. C. Sheehy, who is also well known in the industry in the Middle West.

The most important line carried by the new concern will be the well-known products of the Northern Paper Mills, such as "Northern" toilet papers, "Northern" interfolded towels and "Northern" roll towels.

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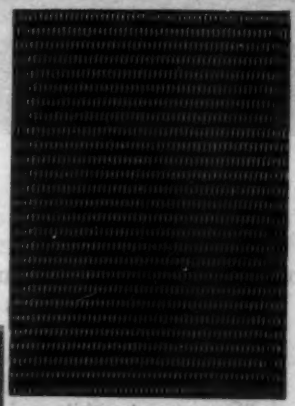
Tyler Corduroy Cloth, for use in the paper making industry, has four distinct advantages over other types of screen, namely:

1—It eliminates the necessity of using backing wires.
2—It gives much longer life than fine face wire.
3—There is no chance for stock to collect between the two covers which occurs where a fine wire and a backing wire are used.
4—Eliminating the backing wire, saves considerable time in applying the cloth to the machine.

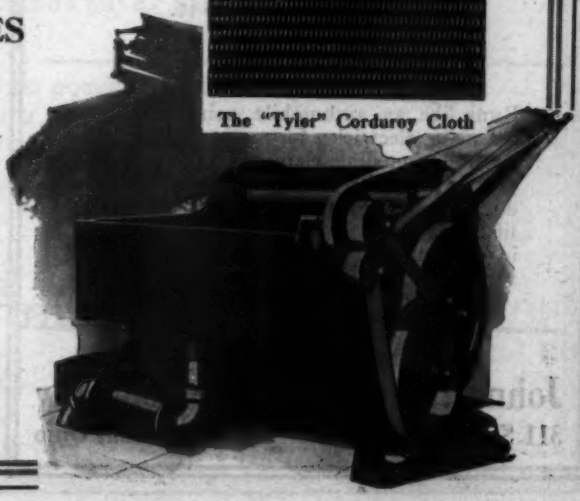
Tyler Corduroy Cloth is made from phosphor bronze, monel, or nickel wire, and is carried in stock in all widths up to and including 150 inches.

Samples will be sent upon request.

Also Manufacture Fourdrinier Wires, Cylinder Faces, Washer Wires, Backing Wires



The "Tyler" Corduroy Cloth



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¶ If you wish to unload pulpwood directly onto your woodpile—

¶ A carload of coal directly into your coal bins—

¶ Remove the accumulated rubbish in and about your wood yard— .

¶ Handle any new machinery from the flat cars—

¶ Dig the excavation for any new addition to your plant—

BYERS' Auto Crane

will go right to the job. You do not have to bring the job to it.

Runs like an automobile, using gasoline, steam or electricity for motive power and does all your sling, clamshell, grab, orange-peel or magnet work equally well. It will do all your regular loading, unloading or lifting work at a saving of many dollars in time and labor, paying for itself in a very short time. *Write for Bulletin No. 1016.*

John F. Byers Machine Company
311 Sycamore Street, Ravenna, Ohio

Memorial Tablet to Jack Fogarty

The program was opened by Earle Murray, master of ceremonies, who spoke of the significance of the occasion, after which he presented W. P. Wagner, president of the company. In his address Mr. Wagner read Lincoln's Gettysburg speech from "A Perfect Tribute" and brought out the comparison between Lincoln's inspiration and that of Mr. North when he wrote his personal appreciation of Mr. Fogarty, published in "The Stub End." In reading this article Mr. Wagner conveyed and pictured the feeling existing between the boys and girls of the mill and the management, and the impressive conclusion brought tears to the eyes of all of us.

Mr. Schiebel then presented his paper:

"I first met Mr. John Fogarty about twenty-eight years ago in Kaukauna, Wis., where we worked together for about one and a half years, after which Mr. Fogarty went to Niagara Falls to be superintendent of a paper mill there. The next I heard of him he was superintendent of the paper mills at Nekoosa, Wis., and in January, 1904, he came to this mill, which was then known as the Northern Tissue Paper Mills. When Mr. Fogarty came to this mill it had only one paper machine, which is No. 1. At that time the whole mill was in what is now No. 1 machine room. Machine room, beaters, finishing room, office, and all else that went to make the mill complete at that time. After Mr. Fogarty had been here about two months the mill had more than doubled its capacity and it was not long after, through his hard work and ambition, the mill became too small to take care of the business it had ahead, so what is now called the old finishing room was built and another paper machine added, and, as some of you know, it is no small job to start a new machine. Mr. Fogarty would not leave the mill until everything was running smooth. I have known times when he had not left the mill for over twenty-four hours, not even to go to meals; in fact we have shared our lunch many times.

"After No. 2 paper machine had been making tissue for some time and the orders were pretty well taken care of, Mr. Fogarty landed a contract for different grades of paper from the best to some of the cheaper grades. These included bible paper, catalogue, news, railroad writing, etc. About this time Mr. M. J. McCormick, who was then general manager, died and Mr. Fogarty was elected to the office. Then his duties were doubled, but this did not make him lose sight of the mill, for at this time paper towels first came on the market, and, seeing a new field, he decided to be one of the first in it, so they set at work to make these towels. At that time the toweling was not made on the paper machine, but was run on a machine almost like the crepe machine we have in the basement, but there was too much time and paper wasted, so Mr. Fogarty got

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HARTJE PAPER MANUFACTURING CO.

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PAPER AND PAPER BOX BOARD

STEUBENVILLE, OHIO, 12/6/19

TO THE TRADE

We wish to announce that we have appointed the Hart Trading Company, Inc., Chicago and New York City, our exclusive sales agents covering our production of News, Krafts and Water Finish Papers.

We would ask the trade to communicate with the Hart Trading Company, Inc., in reference to the sale of any of our Fourdrinier Machine products.

Yours very truly,

By a. f. Campbell
President.

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JOSEPH GATTI, *President*

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busy and invented what is called a doctor blade and made the crepe right on the paper machine. As soon as the public began to see these towels, the orders began to come too fast again for the mill to take care of them, so what is now the new finishing room and No. 3, 4 and 5 machine room was built.

"Mr. Fogarty was a paper mill man, not only a paper maker, for when he needed something if he could not find what he wanted he would build it himself or have it built according to his ideas, and, as most of us know, nearly all the machines that are in the mill today are either inventions of his or there are improvements on the machines bought. The rewinders and the core machines and other machines are inventions of his own from start to finish. When the mill was in full operation they crowded the office force out, so an office was built for them, but their force, too, began to outgrow their home, and the large new office we have today was built and the old one used for a doctor's office and hospital.

"The sulphite mill was also built about this same time, and with these additions it was the largest mill of its kind in the world.

"In the twenty-eight years I have known Mr. Fogarty, he has always been the same, for no matter where we met, it was always the same Good morning, Joe, or Good morning, Jack, and we always knew each other as Joe and Jack. I have seen him try many things during our long friendship and can recall but one instance where what he tried was a total failure. That was one day when there was something wrong with one of the boilers and Mr. Fogarty was trying to get in the man hole; the hole was about large enough for a man half his size, so you can see there was no job he was afraid of. Whatever there was to be done he would do it, regardless of dirt or grease, and that, no doubt, is the reason he was so successful, and there is no telling, had he lived a few years longer, what he might have accomplished.

"Mr. Fogarty was always known as the working man's friend. He always had a pleasant smile and good word for everyone no matter where he met any of his employes. He seemed to recognize them, and as there are about 500 we can see he had a very good memory. He never forgot his employes and was always first to offer anything new; this mill was the first in this part of the country to get the eight-hour day. He also gave us the free doctor, free nurse, free operations, free hospital, free insurance and a band second to none.

"All these things Mr. Fogarty put into that big monument of his, and the motto: 'More than a place to work,' was the foundation upon which it was built."

The National Appliance Company of Elgin, Ill., announces that it has organized for the purpose of

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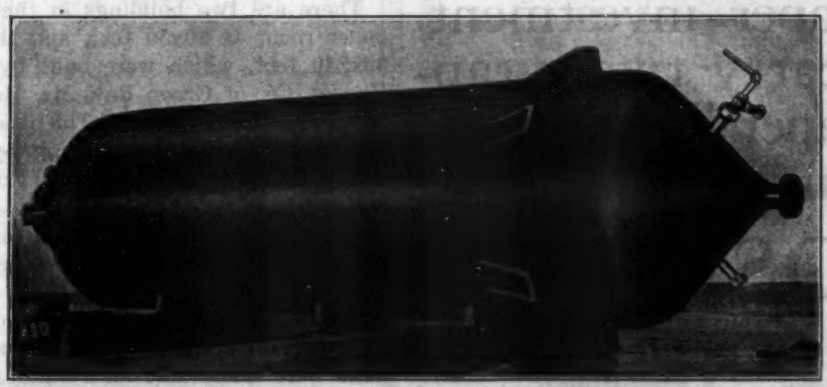
SEAMLESS WELDED DIGESTERS and TANKS

of All Kinds for

PAPER and PULP MILLS



Testing Seamless Hammer Forged Welded Sulphate Digester for Brown Corporation, La Tuque Mill, Quebec.

WITH your mill running 24 hours per day and still unable to meet all the demands of your customers, a leak in your digesters or tanks, causing a temporary shut-down for repairs, means a big loss to you. You will avoid all this trouble if you install Kellogg's Seamless Digesters and Tanks, welded by the Forge and Hammer Process, which produces the strongest weld of any process in existence.

We make them of any thickness, diameter or length for paper and pulp mill uses

To the man that is willing to be "shown," just ask us to prove their economy and efficiency. A letter will start the ball-a-rolling.

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Cut down *excessive* wrapping paper investment. Why carry two wrapping paper lines for one wrapping paper *purpose?*

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presents a perfect wrapping paper, weight and strength for each wrapping purpose. Made in all weights from 15 pounds to 100 pounds basis. The one complete, standardized and economical line of wrapping paper sold.

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"The Wrapper that Delivers the Goods"

supplying the pulp and paper mills with chemicals, chemical apparatus, colors, book cloth, gas masks, safety supplies and general merchandise used by the industry. Inquiries and requests for quotations will receive prompt attention.

Fort Howard Paper Co.

Among the new mills that are now building is that of the Fort Howard Paper Co., at Green Bay, Wis. This company was organized by A. E. Cofrin, formerly general superintendent of the Northern Paper Mills of Green Bay.

This company selected an ideal site for a paper mill, on the banks of the Fox River, a site of sixteen acres of ground, to give them plenty of space for future expansion. They have a water front, which will later be developed, so that coal and pulp can be brought to the door of the plant. Trolley lines pass the door.

Green Bay is an ideal shipping point, both for water shipment on the great lakes and three railroads.

There are two buildings in the present plant, a boiler room of 30x50 feet, and the main building, 65x240 feet, which were built by the Ludolph M. Hanson Co. of Green Bay, Mr. Hanson being vice-president of the company. The paper machine, which will trim 127 inches, was built by the Beloit Iron Works Co., Beloit, Wis., and will turn out fifteen tons daily of high-grade toilet tissues, crepe paper, such as napkins, toweling and crepe toilets. The necessary equipment has been installed for furnishing napkins folded or flat.

Noble & Wood Machine Co., of Hoosick Falls, N. Y., furnished the beating engines, while the Jordans were manufactured by the Appleton Machine Co., Appleton, Wis.

The other officer, aside from Mr. Cofrin, who will be the secretary, treasurer and general manager, and Mr. Hansen, the president of the company, is Samuel H. Cady, one of the best known men in Green Bay.

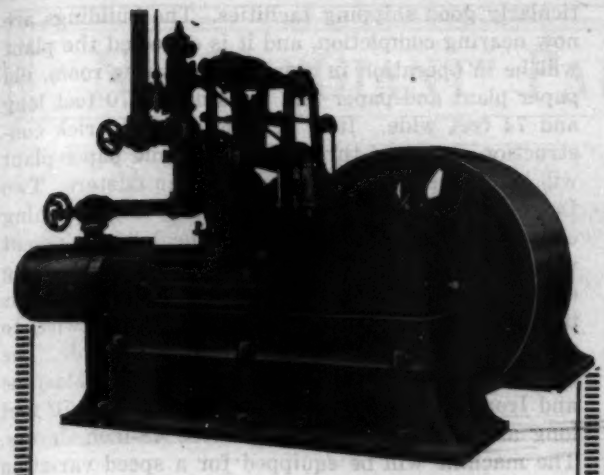
This plant will be ready to turn out paper in several months, and many orders have already been received.

The Chillicothe Paper Co.

Another new paper mill is being built at Chillicothe, Ohio, to be known as the Chillicothe Paper Co., with the following named officers, some of whom were formerly connected with the plant of the Mead Pulp and Paper Co., in the same city: President, Hector McVicker; vice-president, George Litter; treasurer, Austin P. Story; secretary, Lyle S. Evans.

This plant will manufacture book, magazine, catalogue and lithograph paper.

This mill is built on the Norfolk & Western and Baltimore & Ohio Railroads, which gives it par-



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Paper Mill Economy is assisted very materially by the installation of High Grade Variable Speed and Constant Speed Engines.

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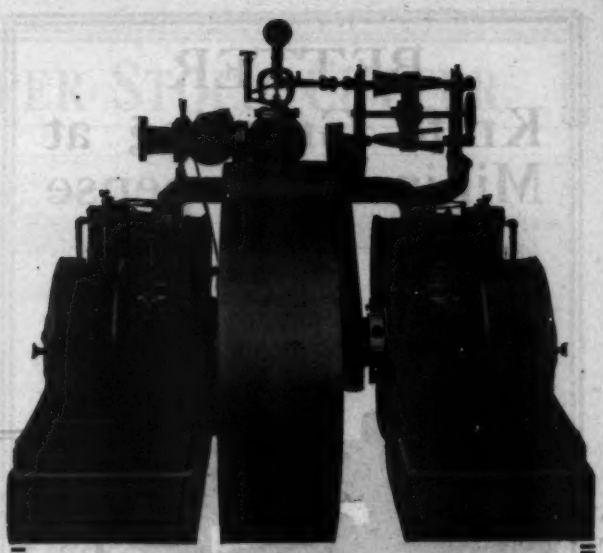

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solves the problem of your variable speed drive. Its reliability results in maximum production. That's why ***one in every three of these engines is a repeat order.***

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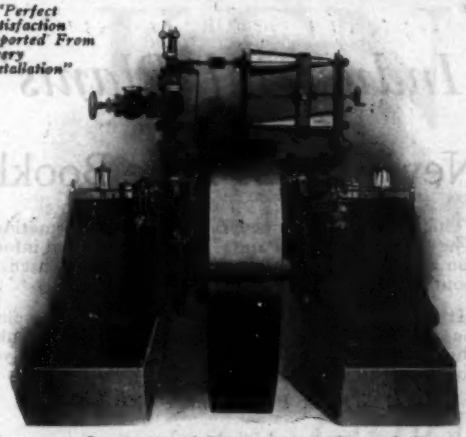
Large, Modern Designed ENGINES

"Perfect Satisfaction Reported From Every Installation"



Economy—Continuity of Performance—Ease of Care and Adjustment—Infrequency of Repairs

These, the important requirements of an engine, are met by "ERIE" double variable speed engines.

To the Paper Mill Trade

We will be glad to furnish full information as to price, delivery and equipment to meet your requirements, and will appreciate an opportunity to furnish these details by mail and the privilege of personal interviews being arranged.

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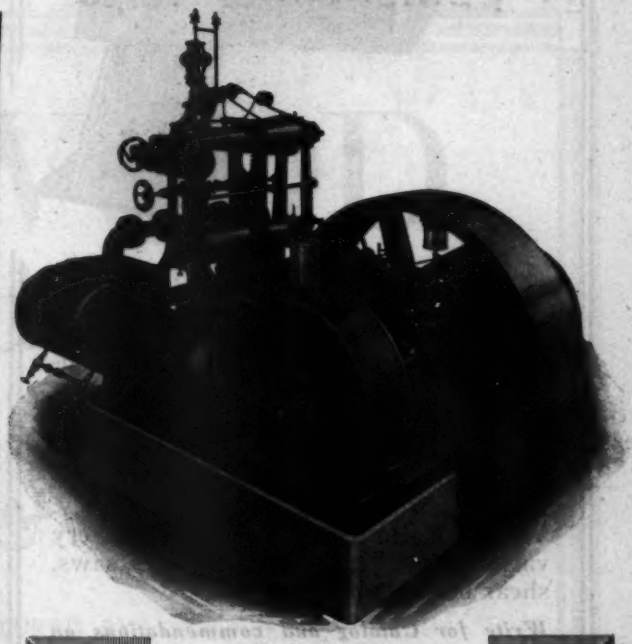


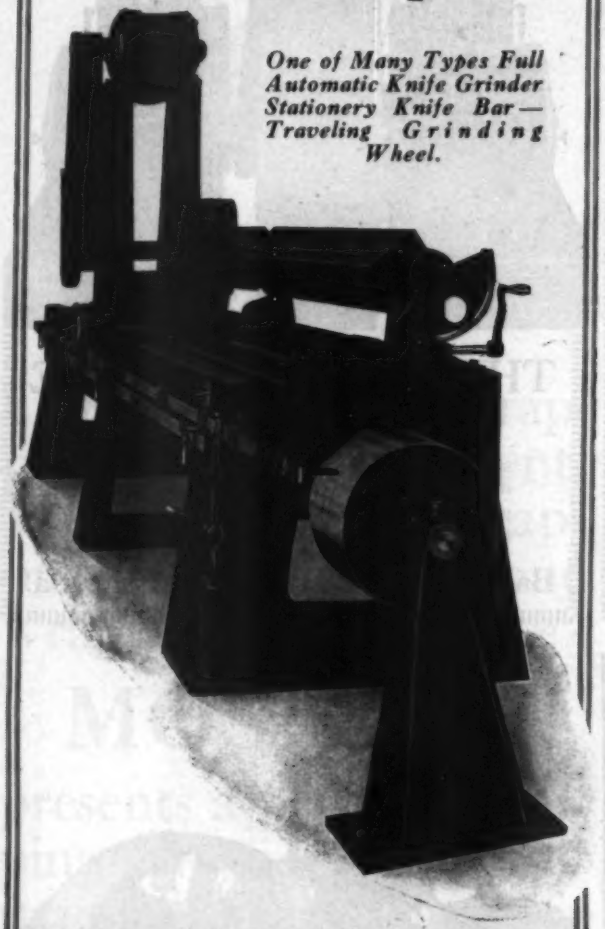
Variable Speed Engine

The engine illustrated above is especially designed to drive paper machines, giving continuous and reliable service. A patented safety device protects your employees and plant.

THE BROWNELL CO., Dayton, Ohio

SEND FOR BULLETIN E-4

BETTER Knife Grinding at Minimum Expense



One of Many Types Full Automatic Knife Grinder Stationery Knife Bar—Traveling Grinding Wheel.

IN these days of high costs, a comparatively low priced machine of strictest accuracy, of simple construction, but full automatic in every respect, and of heavy, rigid build, insuring long service, offers real economy in keeping all knives from 6-inch to 190-inch, up to highest cutting efficiency. We make all types of grinders for every variety of service in fitting knives, saws, shear blades, etc.

Write for Catalog and commendations on your requirements.

Machinery Co. of America

Big Rapids, Michigan, U. S. A.

Branch: Seattle, Wash.

ticularly good shipping facilities. The buildings are now nearing completion, and it is expected the plant will be in operation in April. The beater room, old paper plant and paper mill building is 470 feet long and 74 feet wide. It is of concrete and brick construction, fireproof throughout. The old paper plant will be equipped with railroad and fan dusters. Two Downington cookers and six washing and bleaching engines will be installed. The beater equipment will consist of six 1,500-pound Noble & Wood beating engines, with two Jordans. One paper machine is being installed at the present time 138-inch wire, to make a finished sheet of paper 126 inches wide. The machine was built by Rice, Barton & Fales Machine and Iron Co., Worcester, Mass. The wire is 70 feet long and there will be thirty-three 48-inch dryers. The machine will be equipped for a speed variation of from 90 to 450 feet per minute. The machine will be equipped with English reels. The output will be from 30 to 35 tons per day.

The mill be electrically operated throughout, the variable speed part of the paper machine to be driven by a turbo generator unit. The turbine is to be of a noncondensing type and the exhaust steam will be used to dry the paper. The finishing room will be equipped with a Moore & White duplex cutter, one stack of super calenders 130 inches wide, and rewinder and trimmer.

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New Free 24 Page Booklet

This book contains several pages of information on "The Composition of Paints" authentic general information about the various pigments and vehicles used; also about the spraying of paints.

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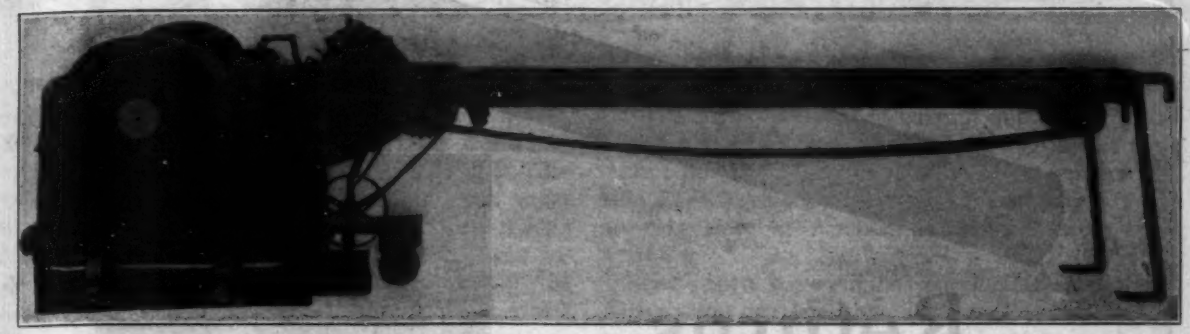

Capacity 2½ Tons Per Hour
Especially Adapted for Handling Waste Paper, Magazines, Etc., Before Feeding to the Beaters

Whatever You Cut, A GIANT Will Solve Your Problem

LET US FIGURE IT OUT FOR YOU

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Felts and Jackets

for every kind of Paper & Pulp

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Returns in SERVICE

EVERY cent of the initial investment—will outlast any known substitute—will more successfully resist corrosion, rust and other causes of deterioration and is ever recognized as the most permanent and ultimately economical installation both in the plant and for surface and underground lines.

U. S. CAST IRON PIPE

2" to 84" Diameter

Bell and Spigot, Flange
Plain End, Threaded, Etc.

Fittings—Standard or
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CAST IRON CYLINDERS FOR PAPER DRYING MACHINERY
HEAVY CASTINGS TO ENGINEER'S DESIGNS

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With the turn of the year, fresh activity has developed in the paper market. Not that the holiday season had any effect on the trade in paper, which is an unusual thing, but since the business world settled down following the Christmas and New Year festivities, demand for practically all kinds of paper has undergone further broadening. Not in a long time has the industry been in quite as strong a position as it now is. Mills in various parts of the country and producing all the varieties of paper and board are sold up for an appreciable time ahead, are running at as full capacity as prevailing conditions will allow, are shipping out every pound of their product immediately it becomes available, and doubtless could easily secure vast amounts of new business if they were able to accommodate it.

Current demand for paper is far in excess of the available supply. Manufacturers have reached a point where they have stopped endeavoring to cope with it, and the policy adopted by the average paper or board mill is to confine their sales solely to regular customers, many of whose wants are going partially unfilled. That there is small likelihood of demand letting down to any extent during the next several months seems assured by the sold-up condition of mills. Representative trade factors declare that should buyers cease operations entirely for a period of two months, or thereabouts, manufacturers could continue running at maximum production on the orders they now have booked.

As would be expected with such conditions obtaining, prices are characterized by extreme firmness and display a strong upward tendency. The news print market is in a very tight position. There is a great clamor for supplies notwithstanding the restrictions placed on consumption by publishers, and buyers are reported paying all manner of prices for news print in the open market, sales having been recorded in some instances at as high as 10 cents per pound for spot shipments. Manufacturers are accepting contracts for news with much caution and are generally refusing to enter into commitments covering periods of greater length than three months. Contract prices range from 4 to 4.50 cents a pound at mills, while quotations in the open market on news print in standard rolls run from 8 to 10 cents.

Another very strong end of the market lies in boards. Demand during the past few weeks has been of an excited character, and the tremendous volume of buying has cleaned up the market of all surplus stocks and has sent prices skyrocketing. Plain chip board has sold in exceptional cases at $80 per ton at mills, although it can be said that from $70 to $75 is a more correct range of current quotations. Manufacturers practically as a unit have disposed of their output for several months hence and consumers who held off in buying and who are now seeking supplies are experiencing much difficulty in covering their wants.

Book papers have climbed another notch in value. Supercalendered book has sold at 11 cents a pound and machine-finished book at 10 to 10.50 cents. It is no secret that some of the largest consumers of this class of paper haven't their requirements covered over the current year, and the opinion is common that book papers of all kinds will be in fully as pointed demand throughout 1920 as they now are. Fine papers are firm in price and are moving in heavy volume. A pleasing feature of the trade in writing papers is the large amount of export business being done, and indications are manufacturers could easily accomplish a much larger trade with foreign buyers if they had the necessary supplies to divert in such directions.

The New Year starts in a most auspicious way. So auspicious, in fact, that 1920 holds promise of being the most prosperous year the American paper industry has ever experienced.

News Personals

The Hill Clutch Company of Cleveland, Ohio, has appointed D. F. Collins eastern representative in charge of the New York branch office at 50 Church street. Mr. Collins has been connected with the general sales department of the company at Cleveland since his discharge from the military service last summer.

Davel & Co., paper exporters and importers, have moved from 100 John street to 15 Platt street, New York, where they occupy more commodious offices.

The Rainbow Paper Corporation, of New York, has been incorporated under New York state laws with a capital of $100,000 to manufacture and deal in paper. G. A. Barron, D. Diamond and W. Catlin were the incorporators.

The New York offices of the Zellerbach Paper Co., of San Francisco, Cal., have been moved from 41 Park Row to Suite 719 in the Mohawk Building, at the corner of Fifth avenue and Twenty-first street.

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—*To* PAPER Manufacturers

Here is a message of interest for you.

¶ We pack forty different grades of Paper Stock.

¶ Our Daily Capacity is 300,000 pounds.

¶ We can give you both Quality and Quantity.

Send us your inquiries on the grades you want to use in your product.

MENDELSON BROS. PAPER STOCK CO.

General Offices, STANDARD OIL BUILDING
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"The house with whom you eventually will trade"

FRANCIS HUGHES COMPANY

Paper Mill Supplies

CORRESPONDENCE SOLICITED

Private Switch on C. B. & Q. Tracks

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Main Paper Stock Co.

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PACKERS OF WASTE PAPER STOCK

Old and New Rags, Bagging, Strings, Etc.

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All of the same high standard of value as

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Eastern Manufacturing Company

GENERAL SALES OFFICES
501 Fifth Avenue NEW YORK
Mills at Bangor and Lincoln, Maine

DANIEL M. HICKS

(INCORPORATED)

IMPORTERS - DEALERS

ESTABLISHED 1895

Foreign and Domestic

Rags, Bagging, Rope and Waste Paper

140 NASSAU ST. NEW YORK U.S.A.

SCREEN PLATES *and* DANDY ROLLS

Watermarking a Specialty

Central Manufacturing Co.

The Quick Service House

KALAMAZOO MICHIGAN

Papermaking Rags

Business of broad scope is reported in papermaking rags and the market is in a semi-booming condition. Consumers are placing orders almost at random and for large quantities, and, under the influence of the lively demand, prices have advanced to high levels and are still on the uptrend. The movement of rags began about the first of December and there has been no let up since; trade activity having gained momentum almost every day. The lull in business which invariably accompanies the Christmas and New Year holidays failed to develop, paper manufacturers continuing to buy with the same consistency that marked their operations prior to that season, and which has been a feature of the market thus far this month. The severe weather throughout the country has hampered collections and available supplies of rags are far from plentiful, which condition wages a strengthening influence on values.

New Stock—	New York and Chicago.
White shirt cuttings, No. 1	16.50-17.00
White shirt cuttings, No. 2	11.00-11.50
Fancy shirt cuttings	11.50-12.00
Washables, No. 1	9.50- 9.75
Unbleached muslins	14.00-14.50
White lawns	14.50-15.00
Overall cuttings, blue	11.00-11.50
Black Silesias	7.00- 7.25
Old Stock—	
Whites, No. 1 repacked	11.00-11.50
Whites, No. 2 repacked	6.00- 6.50
Whites, house soiled	4.00- 4.25
Whites, street soiled	3.75- 4.00
Thirds and blues, repacked	4.50- 4.75
Thirds and blues, rough	4.00- 4.25
Black stockings	3.50- 3.75
Lace curtains	8.50- 9.00
Cotton canvas, No. 1	5.00- 5.25
White cotton batting	5.00- 5.25
Roofing, No. 1	3.25- 3.50
Roofing, No. 2	3.10- 3.25

Rope and Bagging

Old ropes are in better demand and prices have moved up a peg over the month. Consuming mills are placing orders for good-sized lots and are meeting the quotations named without apparent reluctance, indicating that they are buying against actual requirements. Between 6.25 and 6.50 cents a pound f. o. b. shipping points for No. 1 Manila is the quotational basis at present, and sales have been definitely recorded at the upper figure. Old bagging is in greater demand than it was prior to the turn of the year, but the market still is devoid of the activity that attends the trade in other papermaking material. This is puzzling to dealers, who are aware that tissue paper mills and other consumers are busily engaged, and is explained only by the belief that enough foreign bagging is being received to permit buyers to limit their operations in the domestic market. Prices are:

	New York and Chicago
Gunny, No. 1 domestic	3.50-3.75
Gunny, No. 1 foreign	3.50-3.75
Scrap bagging, No. 1	3.00-3.15
Roofing bagging	2.60-2.80
Wool tares, heavy	3.50-3.75
Wool tares, light	3.25-3.50
Manila rope, No. 1 foreign	6.25-6.50
Manila rope, No. 1 domestic	6.25-6.50
Sisal strings	3.25-3.50
Mixed strings	2.75-2.85

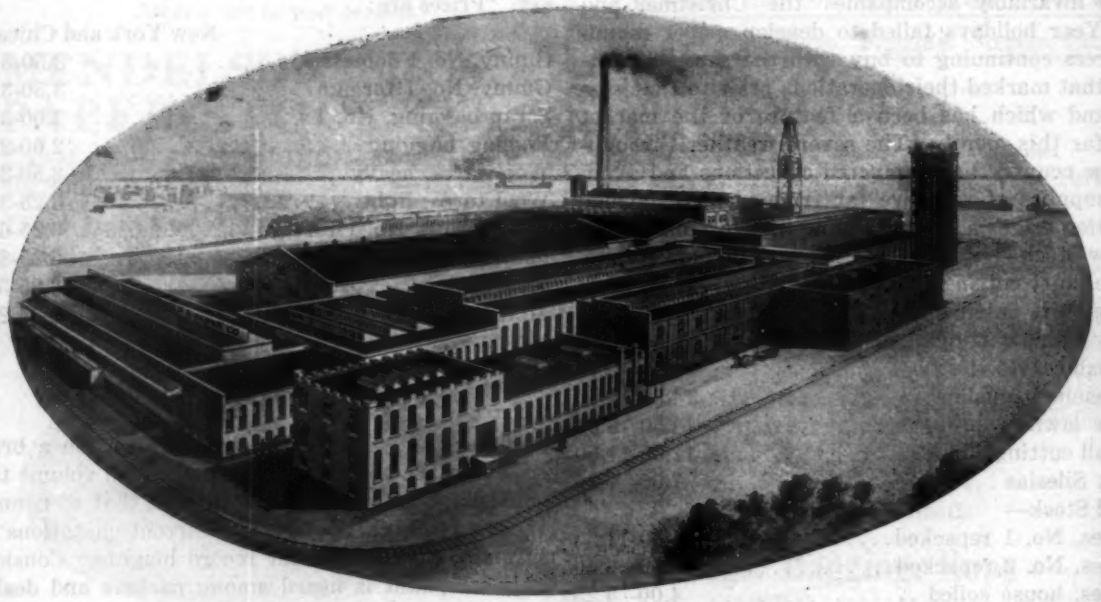
Old Papers

Buyers of waste paper are operating on a broad scale and are absorbing supplies in such volume that could have but one effect on prices, that of running them up to higher levels, and current quotations are in many cases very near record heights. Considerable complaint is heard among packers and dealers anent the difficulty in acquiring fresh supplies of customary proportions, it being asserted that the high cost of newspaper causes consumers to be more economical in their wastage, with the consequence that less paper stock is being produced. As an illustration of the high prices ruling on old paper, sales of white blank news cuttings have been recorded at levels in excess of what news print paper in standard rolls sold for before the war. Overissue newspapers are another particularly strong item, and No. 1 packing is selling at 1.75 cents a pound at shipping points. Shavings rule firm and are moving in consistent volume, while a ready outlet prevails for flat stock of all kinds. Board mills are buying low grades in large quantities and at stiff prices. Quotations follow:

	New York and Chicago
Hard white shavings, No. 1	5.60-5.80
Hard white shavings, No. 2-3	4.75-5.00
Soft white shavings	4.50-4.75

Detroit Sulphite Pulp and Paper Co.

Makers of Paper of Strength



Cylinder
Fourdrinier
Machine Glazed
Mitscherlich Sulphite

Detroit, Michigan

Colored shavings	2.00-2.25
Heavy book, No. 1	2.50-2.65
Crumpled, No. 1	2.10-2.25
Ledger stock	2.80-3.00
Kraft, No. 1	3.35-3.50
Manilas, No. 1	1.50-1.60
White blank news	2.90-3.00
Overissue news, No. 1	1.70-1.80
Folded news	1.10-1.20
Mill wrappers	1.15-1.25
Box board cuttings	.95-1.00
Mixed paper, No. 1	.87- .95
Common paper	.75- .82

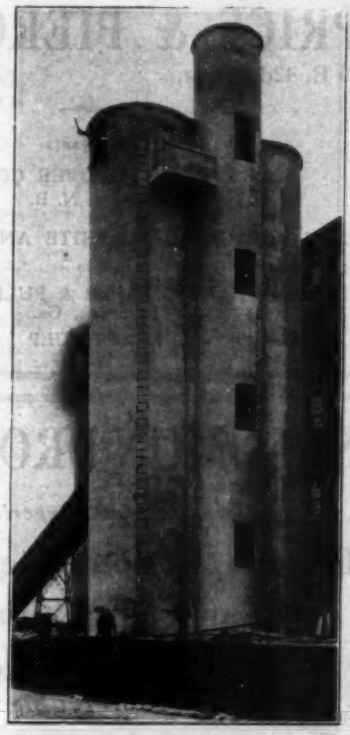
News Personals

Philip T. Dodge, president of the International Paper Co., of 30 Broad street, New York, returned a few days ago from a two months' visit to England, France, Germany and Switzerland. Mr. Dodge stated that his observations in Europe lead him to believe that American manufacturers of news print paper have little to fear in the way of competition from European producers of paper, labor costs abroad having increased in such a measure that cheap production there is no longer possible.

Jenssen Two-Tower Acid System

56 Installations in operation or under construction on this Continent or Abroad

G. D. Jenssen Company
200 Fifth Avenue
New York



Jenssen Acid Towers at Great Northern Paper Co. Mill at Millinocket, Maine

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All Grades of PAPER and BOARDS

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Incorporated
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Established 1870

WIDNEY MODULIMETER
A TEST

This instrument will tell the physical properties of ANY material, and will show its "molecular life" or "recovrance," and this directly indicates its durability.

Now you can KNOW when you BUY or SELL, just what values you have and how they will ENDURE.

The Widney Co. *Testing Engineers*
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FOR SALE

Two—54" Dietz Slitters and Rewinders
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One—10x15 single-color Harris Press
One—Hamblet Roll Sheet Cutter
One—40" Cutter Blade—Table 36"
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For Details Write Purchasing Department
CONTINENTAL PAPER BAG COMPANY
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Mills at
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CHEMICAL WOOD PULP *of* **ALL KINDS**

Dealers in
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Agents for **PAPER MILL SUPPLIES**

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FREDERICK BERTUCH, SPECIAL PARTNER
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BLEACHED AND UNBLEACHED

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PRICE & PIERCE, Ltd.

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Also
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Member Am. Soc. C. E.
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PAPER, PULP AND FIBRE MILLS INCLUDING BUILDINGS AND COMPLETE MECHANICAL EQUIPMENT
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Importers and Exporters of

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Import of All Grades of Rags and Rope

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Vito G. Cantasano & Bros.

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PAPER STOCK, COTTON AND WOOLEN RAGS.

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NEW YORK

New Papers

Writing—	
White rag	20-40
White sulphite, No. 1	12-20
Colored	14-23
Ledger—	
White rag	20-42
White sulphite	14-22
Colored sulphite	16-
Colored rag	22-
Bonds—	
White rag	17-47
White sulphite	13-22
Colored sulphite	14-26
Colored rag	17-50
Book—	
No. 1 S. & S. C	10.50-11.00
Machine finished	10.00-10.50
English finished	11.00-13.00
Coated and enamel	12.00-15.00
Lithograph, M. F	10.00-13.00
News Print—	
Rolls, contract	4.00- 4.50
Rolls, transient	8.00-10.00
Sheets	7.00- 8.00
Side runs	6.00- 6.50
Cover Stock—	
Coated, both sides	12.25-
Coated, one side	12.20-
Wrappings—	
No. 1 kraft	8.50- 9.00
No. 2 kraft	7.75- 8.25
Boards—	New York and Chicago.
Solid news	75.00-85.00
Straw	60.00-70.00
Plain chip	70.00-75.00
White coated chip	80.00-85.00
Manila coated chip	75.00-80.00
Binders board	80.00-90.00

Chemical Pulp

The market for chemical wood pulps is in a strong condition. Demand during the past several weeks has not been as excited as at intervals prior to the holiday period, but buyers have operated in a manner that leaves no doubt that they are consuming large quantities of pulp and that mill stocks are at a low level. Possibly more business could have been transacted had the market not been so bare of sizable accumulations of unsold pulp. Producers for the most part have been and still are more concerned over filling present commitments than in booking new orders, and offerings in the open market are decidedly sparse. Sulphite of all grades is in active demand, with an especially good inquiry for bleached sulphite, easy bleaching and news print sulphite. Prices are undergoing a hardening process and further advancement appears inevitable unless available supplies increase to a point more in keeping with the needs of paper manufacturers. Quotations f. o. b. pulp mills are:

Bleached sulphite	6.00-6.25
Easy bleaching sulphite	4.50-5.00
News grade sulphite	3.50-3.75
Soda pulp, bleached	4.50-5.00
Mitscherlich unbleached	5.00-5.25
Kraft, No. 1	3.75-4.00
Screenings, refined	1.75-2.00

Mechanical Pulp

Buyers of mechanically ground wood continue to encounter difficulty in locating all the pulp wanted; demand having all the earmarks of being in excess of offered supplies, and quotations are characterized by an exceedingly strong undertone. The severe weather in most grinding sections has had the effect of curtailing production to quite an extent, which in turn wages a bullish influence on the market. Current quotations on mechanical spruce pulp of prime quality range from $50 to $60 per ton at grinding plants. Sales have been recorded at close to the higher level, and, in fact, it is doubtful whether sizable tonnages for prompt delivery can be obtained at $50. News print manufacturers are repeatedly coming into the market to acquire pulp to augment their contract supplies, while demand from other quarters is more than ample to absorb all the supply producers have to offer.

Chemicals

Demand for pulp and papermaking chemicals is steady and active and quotations throughout the list are firmly maintained, with such changes as have occurred generally in an upward direction. Latest quotations are:

Alum, lump ammonia	4.00- 4.25
Alum, lump starch	8.25- 8.50
Alum, powdered	4.25- 4.50
Blanc fixe	4.50- 5.00
Bleaching powder (domestic drums)	2.25- 2.50

F. G. MARQUARDT, President
HUGO THUM, Vice-Pres. CHAS. E. RAND, Secy.
A. D. LORENZ, Treasurer

F. G. Marquardt, Inc.

PAPER

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Paper Makers' Supplies

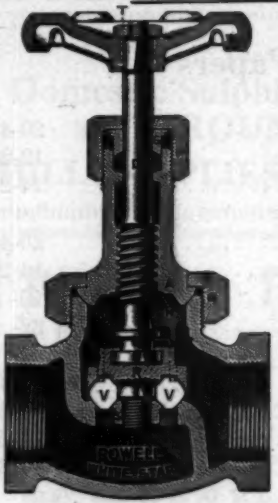
345 Broadway, New York City

Packing House
ROCKVILLE CENTRE
NEW YORK

Special Attention Called to Our Own Packing and Assortment

POWELL VALVES

(Especially The "White Star" Valve)



MORE THAN THREE WISE MEN AND NUMEROUS OTHERS HAVE USED THE POWELL WHITE STAR VALVES. OUR REPUTATION FOR QUALITY IS ALWAYS MAINTAINED BY OUR SUPERIOR MANUFACTURING FACILITIES WHICH ENABLE US TO FILL EVERY REQUIREMENT.

Ask your dealer for "Powell" Valves— or write us.

THE WM. POWELL CO

DEPENDABLE ENGINEERING SPECIALTIES.

Established in 1846

CINCINNATI, O.

¶ Are you receiving all the Clay you need and the grade that you want? Or are you accepting any old grade just so long as you can get delivery.

¶ Our customers are receiving the same grade as usual and do not even know there is a shortage.

¶ We are in a position to give this same Service to you on

Washed Clay

Because—

QUANTITY: Largest production in United States.

QUALITY: Lowest grit and moisture contents of any clay, domestic or foreign.

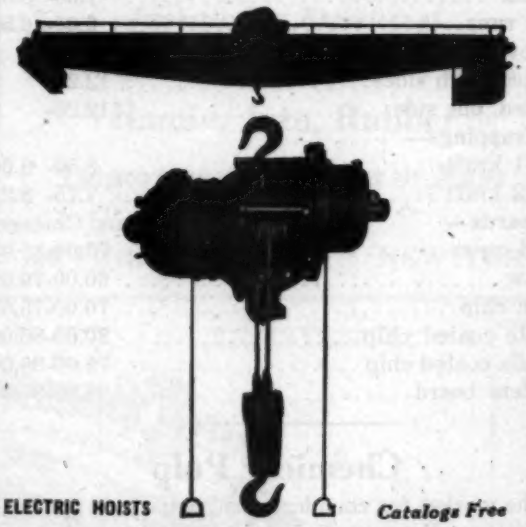
DELIVERIES: Reserve stock never under 6000 tons.

PLANTS: Three huge plants at McIntyre, Ga., under direct control of Edgar Bros. Co., also Saylorsburg, Pa., and Gordon, Ga.

CRUDE CLAY: Paragon and Excelsior Brands.

MINER-EDGAR CO.
30 Church St. New York

"NORTHERN" means SATISFACTION



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NORTHERN CRANES

NORTHERN ENGINEERING WORKS. DETROIT, MICH.

Brimstone (ton)	18.00-20.00
Casein	13.00-15.00
Caustic soda, spot delivery	3.50- 3.75
China clay, domestic, washed	11.00-12.00
China clay, foreign	18.00-24.00
Rosin, grade E	18.15-18.25
Satin white	2.25- 2.50
Soda ash, 58 per cent light (bags)	1.90- 2.00
Sulphite of alumina, commercial grade	1.75- 2.00
Starch, Globe, in bags	5.97-
Talc (ton)	16.00-16.50

The Cliff Paper Co., of Niagara Falls, N. Y., has increased its capital stock from $200,000 to $400,000, according to a notice filed in the office of the Secretary of State at Albany, N. Y.

The Hercules Paper Corporation, recently organized by New York interests, has added another group of mills to its properties, having acquired controlling interest in the Frank Gilbert Paper Co. of Waterford, N. Y., from the latter company's president, H. I. Prankard. The Gilbert company is one of the oldest producers of paper in the United States and operates three mills—a pulp mill in Cohoes, N. Y., and paper mills in Waterford and Cohoes. Mr. Prankard is to become vice president of the Hercules Paper Corporation as head of its division of manufacture, embracing the mills already acquired and those it may erect or acquire. The Hercules combine, which is a Delaware corporation, has just increased its capitalization from $10,000,000 to $20,000,000.

The Niagara Paper Mills Co., of Lockport, N. Y., has increased its capital stock from $100,000 to $250,000.

H. G. Craig & Co., of New York, one of the foremost factors in the country in the distribution of paper of various kinds and wood pulp, recently announced that Arthur C. Hastings, widely known in the paper industry, had been admitted to their firm. Mr. Hastings was for five years president of the American Paper and Pulp Association.

Premier Shipping Co.
INCORPORATED
32 Broadway, New York

Freight Contractors
AND
Forwarding Agents
Customs Brokers

Specializing in Handling of Export and Import Shipments of Paper

Members of
Freight Brokers
Products Exchange
Maritime Exchange
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Large Arch and Square Blocks a Specialty
All Shapes and Sizes
PROMPT DELIVERIES
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FOURDRINIER WIRES
and All Meshes of
PAPER MILL WIRE CLOTH
Appleton Wisconsin

UNION SCREEN PLATE CO.
Fitchburg, Mass., U. S. A. Lennoxville, P. Q., Canada
UNION BRONZE SCREEN PLATES
(Best phosphorized Cast Metal)
Old Plates RECLOSED and RECUT to accurate gauge
UNION BRONZE SCREWS for Screen Plates
Immediate Delivery of the Largest Orders. Satisfaction Guaranteed
The Witham Screen Plate Fastener, Patented
THE ORIGINAL THE BEST

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RYDÖ STRONG SWEDISH UNBLEACHED SULPHITE IN STOCK

E. J. KELLER COMPANY

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FOREIGN AND DOMESTIC

PAPER MAKERS' SUPPLIES
COTTON, JUTE AND FLAX WASTES
COTTON BAGGING MATERIALS
EAST INDIA MERCHANDISE

Waterproof Case Lining

Protects your Shipments from damage by moisture while in storage or transit

NATIONAL DUPLEX

We can supply National Duplex Waterproof Case Lining in either rolls or sheets

TRADE MARK

We also make Wax Papers, all weights, of Manila Filer and Kraft, in Sheets or Rolls

Write for Samples

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HAMMERMILL LEDGER

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The Standard Utility Business Papers and the Most Widely Used Papers in the World

MADE BY

HAMMERMILL PAPER CO., Erie, Pa.

NEW YORK OFFICE: 291 BROADWAY

Remember

WM. A. HARDY & SONS

FITCHBURG, MASS.

Originators and Oldest Manufacturers

OF THE

Cast Bronze Screen Plate

ALSO SPECIALIZE IN

Acid Resisting Digester Parts

FRANK F. ALT

LA FAYETTE, INDIANA

Converter of Paper Mill Felts into finished Bed Blankets and Auto Robes at the nominal charge of $1.00 per blanket or robe, except press felts, which are $1.25 per blanket or robe.

We cut, wash, renap, bind and pack for reshipment at the above prices in the natural color of felt, and in any quantity for mills or individuals. For dyeing any other color we charge 30 cents per pound extra, dry weight after material is washed.

Ship your felts express, freight or parcel post, prepaid to

421 Columbia Street, La Fayette, Ind.

Chemical Pulp

This is the season when not much wood pulp is shipped by Swedish manufacturers to the United States, the Baltic Sea being frozen over and open water navigation stopped until the spring. Fresh arrivals therefore are light, and there is very little pulp available in the market here for trading purposes. Such consignments as have been received during the past month have chiefly consisted of pulp sold to arrive and have had a more or less negligible influence on the market. All reports from Scandinavia tell of a very firm market there, with high prices ruling. Production in both Norway and Sweden is limited by scarcities of wood, sulphur and other raw materials, and also by the high cost and shortage of labor. These primary conditions obviously are creative of strength in quotations on this side. Receipts at New York during the past month and current quotations follow:

Bleached sulphite	$7.00-7.50
Unbleached sulphite, No. 1	4.75-5.00
Easy bleaching	5.50-6.00
Mitscherlich unbleached	5.50-5.75
Kraft	4.00-4.25

Brown Bros. & Co., 500 bls. from Hamburg; American Woodpulp Corp., 5,537 bls. from Christiania and 4,500 bls. from Gothenburg; Acer & Co., 9,428 bls. from Clark City; E. M. Sergeant & Co., 800 bls. from Christiania and 243 bls. from Gothenburg; National Bank of Commerce, 4,200 bls. from Gothenburg and 844 bls. from Copenhagen; Corin Bros., 700 bls. from Gothenburg; M. Gottesman & Co., 125 bls. from Gothenburg; J. Anderson & Co., 1 ble. from Gothenburg; J. F. Whitney & Co., 3,601 bls. from Liverpool, N. S.; J. F. Patton & Co., 1,200 bls. from Copenhagen; A. J. Pagel & Co., 1,125 bls. from Copenhagen; Lagerloef Trading Co., 25 bls. from Rotterdam; Order, 11,054 bls. from Clark City.

Paper Stock

Importations of papermaking rags from European countries have fallen off to an extent, yet supplies continue to arrive steadily and in comparatively large volume. Naturally it could not be expected that imports would keep up at the rate established in September, October and November, when foreign supplies coming into the United States reached their zenith and when the bulk of the rags accumulated in Europe over a period of three to four years were received, and importations have simmered down more to normal proportions. Arrivals of old rope and bagging also have decreased. Importers report a strong demand from consuming quarters for all kinds of foreign material, and the maintenance of prices on firm levels.

Foreign Trade Opportunities

A consular officer of a foreign country in the United States desires to secure estimates on the full equipment for his country of plants for the manufacture of paper, parchment, cardboard and carbon paper. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 31560.

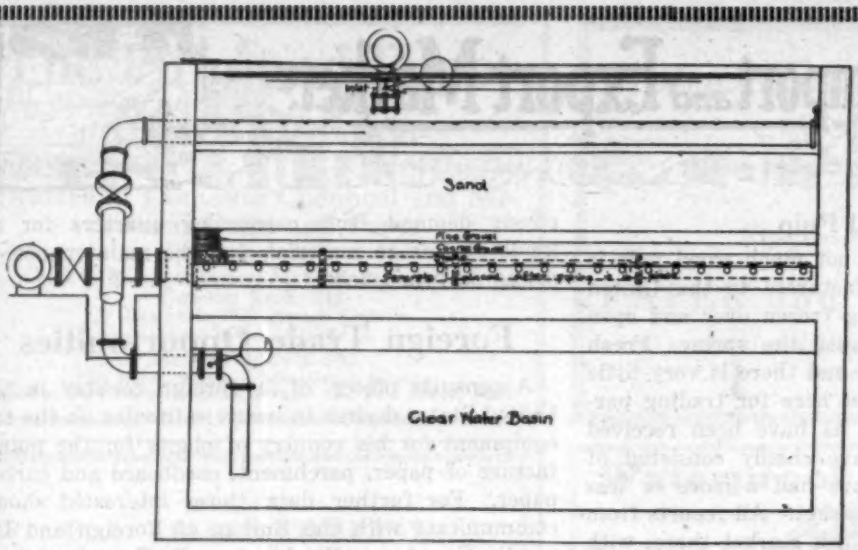
The purchase is desired by a man in Spain of wall paper of all kinds. Quotations should be given c. i. f. Spanish ports. Payment, cash against documents. Correspondence may be in English. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 31565.

A manufacturing firm in France desires to purchase for trial 5,000 to 10,000 paper bags to contain 50 and 100 liters of powdered lime, such bags to be of a quality and type which will permit their use in place of cloth bags. Quotations should be given c. i. f. St. Nazaire or Nantes. Payment, cash. Correspondence may be in English. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 31567.

A firm of selling representatives in the British West Indies desires to secure agencies for the sale of paper. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 31540.

A firm in Greece desires to secure an agency from manufacturers for the sale of paper and stationery. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 31450.

A company in the Canary Island desires to secure an agency for the sale of tissue paper. Quotations should be given c. i. f. the Canaries, via Liverpool.



A Special Filter for Paper Mills

producing just the results you want. It is a modification of the well-known

Hungerford Filter

and has been adapted especially for paper mill use.

The Filter is built of concrete and employs wrought iron pipe, brass strainers and heavy brass laterals for the air wash system. **This filter can be sold for considerable less than any other filter on the market.**

Send for full particulars

Hungerford & Terry, Inc., Philadelphia, Pa.

PAPER MAKERS'

ALUM

(BOTH COMMERCIAL AND FREE FROM IRON)

Casein, Satin White, English China Clay, Boro Phosphate (Crystal)

THE KALBFLEISCH CORPORATION

31 UNION SQUARE WEST NEW YORK, N. Y.

Correspondence should be in Spanish. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 31452.

A man in Egypt who is planning to erect a plant to produce all paper and packages required by the local cigarette industry desires to purchase paper mill equipment, machinery for printing plant, for making cardboard boxes, etc. Quotations should be given c. i. f. Egyptian port. Payment cash. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 31463.

A Chinese resident in the United States, desiring to export American goods to China, proposes to open a commission house, and wishes to receive catalogues and price lists of paper and stationery, old newspaper and various other commodities. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 31457.

An American exporting firm desires to be placed in communication with manufacturers of wrapping paper. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 31467.

Nineteen Twenty

WE enter the year 1920 with perhaps more than our usual amount of confidence in the reward of true merit. This faith is probably prompted by our increased facilities to render even better service than heretofore.

With our new shops and co-operative laboratory for tests in commercial quantities we offer a quality of engineering and construction services in which we are very proud.

May we have the pleasure of discussing your evaporator problems with you?

Swenson Evaporator Co.

Main office—945 Monadnock Building : CHICAGO
Cable address—"Evaporator Chicago"
Eastern office—318 Widener Building : Philadelphia

SMITH HYDRAULIC TURBINES

Accompanying view shows one of eight horizontal shaft "SMITH" Turbine units in successful operation in the Cornell Wood Products Co. mill at Cornell, Wis. Each unit develops 1550 H.P. under 37' 6" head.

FOR STABILITY AND EFFICIENCY SMITH TURBINES ARE UNEXCELLED

If interested, write for Bulletin "S"

S. MORGAN SMITH CO., York, Pa.

BRANCH OFFICES:
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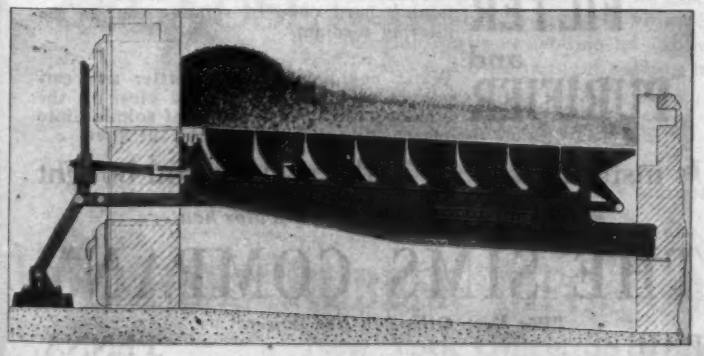

CARRIGAN Hand Stoker saves 10 to 25% of your fuel

Can be installed in any boiler setting without changing the brick work. Is practically smokeless and disposes of the ash and clinker mechanically. Does the work of the rake, poker and slicebar mechanically. Burns any grade of coal. Costs one-third to one-sixth of automatic stoker.

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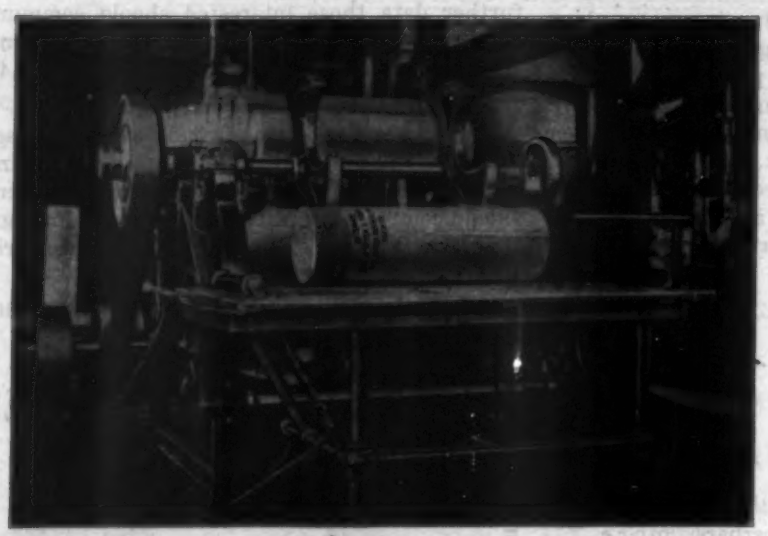
CONSULTING AND SALES ENGINEERING
CUNARD BUILDING, CHICAGO, ILLINOIS

EFFICIENCY IN WRAPPING ROLLS



is only obtainable by the use of the

Power Roll Wrapper

Wraps and stencils Rolls at a saving of from fifty to seventy-five per cent.

Nekoosa Motor & Machine Company

Manufacturers and Sole Agents

NEKOOSA, WIS., U.S.A.

The "SIMS" Open Feed WATER HEATER, FILTER & PURIFIER

WHEN you buy a water heater, or anything else for that matter, you do not actually buy a water heater, but what it will do.

"SIMS" Open Feed Water Heater, Filter and Purifier is the product of Modern Engineering Science and has met the demand for greater efficiency.

OPEN FEED construction is the most simple and effective principle of feed water heating and has less maintenance troubles and operating costs than any other type.

WATER HEATER feeds your boilers with hot water, reduces the strain from contraction and expansion due to feeding cold water and effects a saving of approximately 14.5% in fuel.

FILTER and PURIFIER the feed water in a filtering chamber containing hard coke of suitable size as the filtering medium.

Water containing earthy matter and carbonate of lime when heated close to the boiling point is thrown out of solution into suspension and is removed by the filter.

Is installed you GET the service you bought

Ask us about the "Sims" feed-water heaters.

THE SIMS COMPANY

"We Keep Others in Hot Water."

ERIE PENNA.

Buyers' Guide—What and Where to Buy

Equipment, Apparatus, Supplies and Raw Materials Used by the Paper Industry

ADHESIVES
The A. P. R. Mfg. Co., 316 West Grand Ave., Chicago.
E. F. Russ Co., 201 Devonshire St., Boston, Mass.

ACID RESISTING BRONZE
Sandusky Foundry & Machine Co., Sandusky, Ohio.
William A. Hardy & Sons, Fitchburg, Mass.

AGITATOR EQUIPMENT
The Hill Clutch Co., Cleveland, Ohio.
Moore & White Co., Philadelphia, Pa.

AIR CONDITIONING AND CONTROL APPARATUS
Bayley Mfg. Co., 732 Greenbush St., Milwaukee, Wis.

ANGLE VALES
The Crane Company, Chicago, Ill.

ARCHITECTS
James L. Carey, 208 N. Laramie St., Chicago.

ASSORTING TABLES
Moore and White Co., Philadelphia, Pa.

ASH CONVEYOR SYSTEMS
American Steam Conveyor Corp., Chicago, Ill.

BARKERS
Holyoke Machine Co., Holyoke, Mass.
Valley Iron Works Co., Appleton, Wis.

BARKING DRUMS
H. O. Numan, Green Bay, Wis.

BEATER BARS
John W. Bolton & Sons, Inc., Lawrence, Mass.
R. J. Dowd Knife Works, Beloit, Wis.
L. & I. J. White Co., Buffalo, N. Y.
Simonds Manufacturing Co., Fitchburg, Mass.

BEATER BED PLATES
John W. Bolton & Sons, Inc., Lawrence, Mass.
R. J. Dowd Knife Works, Beloit, Wis.
L. & I. J. White Co., Buffalo, N. Y.
Simonds Manufacturing Co., Fitchburg, Mass.

BEATER ROLL FILLING
John W. Bolton & Sons, Inc., Lawrence, Mass.
R. J. Dowd Knife Works, Beloit, Wis.
L. & I. J. White Co., Buffalo, N. Y.
Simonds Manufacturing Co., Fitchburg, Mass.

BEATING, WASHING AND BLEACHING ENGINES
Beloit Iron Works, Beloit, Wis.
The Black-Clawson Co., Hamilton, Ohio.
Dilts Machine Co., Inc., Fulton, N. Y.
Holyoke Machine Co., Holyoke, Mass.
Valley Iron Works Co., Appleton, Wis.

BEATERS (Continuous)
Claflin Engineering Co., Lancaster, Ohio.
The Griley-Unkle Eng. Co., Ft. Wayne, Ind.
Bird Machine Co., East Walpole, Mass.

BELTING (Rubber)
United States Rubber Co., New York and Chicago

BELT DRIVES
The Hill Clutch Co., Cleveland, Ohio.

BLEACHING (Propellers)
Moore and White Co., Philadelphia, Pa.

BLANKETS
Frank F. Alt, 421 Columbia St., La Fayette, Ind.

BLOWERS
Buffalo Steam Pump Co., Buffalo, N. Y.

BOARD MACHINES
Beloit Iron Works, Beloit, Wis.

BOARDS (Straw)
The C. L. La Bolteaux Co., Cincinnati, O.

BOILER FEEDER
The Farnsworth Co., Conshohocken, Pa.

BRASS WIRE CLOTH
Appleton Wire Works, Appleton, Wis.
Cheney Bigelow Wire Works, Springfield, Mass.
Lindsay Wire Weaving Co., Cleveland, Ohio.
W. S. Tyler Co., Cleveland, Ohio.
Wisconsin Wire Works, Appleton, Wis.

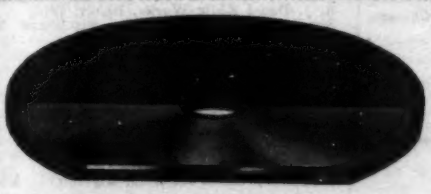
BROKERS & FORWARDING AGENTS
Premier Shipping Co., 32 Broadway, N. Y. C.

BRIMSTONE
Union Sulphur Co., 17 Battery Place, New York City.

BRONZE JACKETS
Sandusky Foundry & Machine Co., Sandusky, Ohio.

BUNDLING SYSTEMS
Signode System, Lake St., Chicago

CALENDERS
Beloit Iron Works, Beloit, Wis.
Holyoke Machine Co., Holyoke, Mass.
The Black-Clawson Co., Hamilton, Ohio.
Dilts Machine Co., Inc., Fulton, N. Y.



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CALENDER DOCTORS
Ticonderoga Machine Works, Ticonderoga, N.Y.

CALENDER ROLLS
Holyoke Machine Co., Holyoke, Mass.
B. F. Perkins and Son, Inc., Holyoke, Mass.

CASEIN
The Casein Mfg. Co., 15 Park Row, N. Y. C.
The Kalbfleisch Corp., 31 Union Square, N. Y. C.

CAST IRON PIPE
U. S. Cast Iron Mfg. Co., Pittsburgh, Pa.
Cast Iron Publicity Bureau, New York City.

CENTRIFUGAL PUMPS
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Valley Iron Works Co., Appleton, Wis.

CHEMICALS
The Grasselli Chemical Co., Cleveland, Ohio.
A. Klipstein & Co., 644 to 652 Greenwich St., New York City.

CHIPPERS
Holyoke Machine Co., Holyoke, Mass.
Valley Iron Works Co., Appleton, Wis.

CHIPPER AND BARKER KNIVES
John W. Bolton & Sons, Inc., Lawrence, Mass.
L. & I. J. White Co., 85 Columbia St., Buffalo, N. Y.
Simonds Manufacturing Co., Fitchburg, Mass.
R. J. Dowd Knife Works, Beloit, Wis.

CLAYS AND FILLERS
Binney & Smith Co., 81 Fulton St., N. Y. C.
Daniel M. Hicks, 140 Nassau St., New York City.
The John W. Higman Co., Inc., 29 Broadway, New York City.
Miner-Edgar Co., 30 Church St., New York City.
International Pulp Co., 41 Park Row, N. Y. C.

COAL BUNKERS
The Brownhoist Co., Cleveland, Ohio.

COATED PAPERS
Bardeen Paper Co., Otsego, Mich.
Bermingham & Prosser, Chicago, Ill.
Bryant Paper Co., Kalamazoo, Mich.
Monarch Paper Co., Kalamazoo, Mich.
Rex Paper Co., Kalamazoo, Mich.
Seaman Paper Co., Chicago, Ill.
Watervliet Paper Co., Watervliet, Mich.

CRANES
The Brownhoist Co., Cleveland, Ohio.
John F. Byers Co., Ravenna, Ohio.
Northern Engineering Works, Detroit, Mich.
The Chisholm-Moore Mfg. Co., Cleveland, O.
The Link Belt Co., Chicago, Ill.

CONSTRUCTION (Building)
The Aladdin Co., Bay City, Mich.

CONSULTING ENGINEERS
Hardy & Furgeson, 200 Fifth Ave., N. Y. C.

CONSULTING ENGINEERS (Power)
J. F. Carrigan Engineering Co., 504 Cunard Bldg., Chicago.

CONVEYORS
Portable Machine Co., Passaic, N. J.

CYLINDER MOLDS
Appleton Wire Works, Appleton, Wis.
Cheney Bigelow Wire Works, Springfield, Mass.
W. S. Tyler Co., Cleveland, Ohio.

DANDY ROLLS
Appleton Wire Works, Appleton, Wis.
Central Mfg. Co., Kalamazoo, Mich.
Cheney Bigelow Wire Works, Springfield, Ohio.
Lindsay Wire Weaving Co., Cleveland, Ohio.
W. S. Tyler Co., Cleveland, Ohio.
Wisconsin Wire Works, Appleton, Wis.

DECKEL FRAME SUPPORTS
Huband and Nash, Menasha, Wis.

DRUM WINDERS
Ticonderoga Machine Co., Ticonderoga, N. Y.

DRYER FELTS
Appleton Woolen Co., Appleton, Wis.
F. C. Huyck & Sons.
Shuler and Benninghofen, Hamilton, Ohio.

DYESTUFFS
Binney & Smith, 81-83 Fulton St., N. Y. City.
E. I. Du Pont de Nemours & Co., Wilmington, Del.
Grasselli Chemical Co., Cleveland, Ohio.
A. Klipstein & Co., 644 to 652 Greenwich St., New York City.

ELEVATORS (Portable)
Economy Engineering Co., Chicago, Ill.
Lakewood Mfg. Co., The, Cleveland, Ohio.

ELECTRIC FANS
B. F. Perkins and Sons, Inc., Holyoke, Mass.

ELECTRIC HOISTS
John F. Byers Machine Co., Ravenna, Ohio.
Northern Engineering Co., Detroit, Mich.

ELEVATING TRUCKS
Economy Engineering Co., Chicago, Ill.
Moore and White, Philadelphia, Pa.

ENGINES
Chandler and Taylor, Indianapolis, Ind.
Erie Engine Works, Erie, Pa.
Hooven, Owens, Rentschler Co., Hamilton, Ohio.

ENGINEERS
James L. Carey, 208 North Laramie St., Chicago, Ill.

EVAPORATORS:
Buffalo Foundry & Machine Co., Buffalo, N. Y.

FASTENERS (Screen Plate)
Union Screen Plate Co., Fitchburg, Mass.

FELTS AND JACKETS
Appleton Woolen Co., Appleton, Wis.
F. C. Huyck & Sons, Albany, N. Y.
Shuler and Benninghofen, Hamilton, Ohio.
Albany Felt Co., Albany, N. Y.

FELT AND WIRE GUIDES
Huband and Nash, Menasha, Wis.
Moore & White Co., Philadelphia, Pa.

FOURDRINIER WIRES
Appleton Wire Works, Appleton, Wis.
Cheney Bigelow Wire Works, Springfield, Mass.
Lindsay Wire Weaving Co., Cleveland, Ohio.
W. S. Tyler Co., Cleveland, Ohio.
Wisconsin Wire Works, Appleton, Wis.

FIBRE MAKING PROCESSES
Hall, Ward & Walker, Inc., Sherman Bldg., Watertown, N. Y.

FILTERS
Hungerford & Terry, Philadelphia, Pa.

FILTER (Continuous Suction)
Green Bay Foundry & Machine Co., Green Bay, Wis.

FRICTION CLUTCHES
The Hill Clutch Co., Cleveland, Ohio.
Moore and White Co., Philadelphia, Pa.

FIRE BRICK
Oliver Bros., 97 Warren St., New York City.

FUSES
Economy Fuse & Mfg. Co., Kinzie and Orleans Sts., Chicago, Ill.

GAS MASKS
National Appliance Co., Elgin, Ill.

GEARS
The Hill Clutch Co., Cleveland, Ohio.

GLUES
American Printers Roller Co., Chicago, Ill.
E. F. Russ Co., 201 Devonshire St., Boston, Mass.

GRINDERS
Holyoke Machine Co., Holyoke, Mass.
Valley Iron Works, Appleton, Wis.

HAND STOKERS
The Files Eng. Co., Inc., Providence, R. I.

HEATERS (Feed Water)
The Sims Co., Erie, Pa.

HOISTING AND CONVEYING SYSTEMS
John F. Byers Machine Co., Ravenna, Ohio.
Northern Engineering Co., Detroit, Mich
The Chisholm-Moore Mfg. Co., Cleveland, Ohio.

HOSE
United States Rubber Co., Chicago, Ill.

HYDRAULIC TURBINES
Holyoke Machine Co., Holyoke, Mass.
James Leffel and Co., Springfield, Ohio.

INDUSTRIAL HOUSES
The Aladdin Co., Bay City, Mich.

JORDAN FILLINGS
J. W. Bolton & Sons, Inc., Lawrence, Mass.

IRON CASTINGS
Beloit Iron Works, Beloit, Wis.
Valley Iron Works Co., Appleton, Wis.

KNIVES
John W. Bolton & Sons, Inc., Lawrence, Mass.
R. J. Dowd Knife Works, Beloit, Wis.
Simonds Manufacturing Co., Fitchburg, Mass.

LAYBOYS
Moore and White Co., Philadelphia, Pa.

LIFT TRUCKS
Economy Engineering Co., Chicago, Ill.
Lakewood Eng. Co., The, Cleveland, O.
Lewis Shepard Mfg. Co., Chicago, Ill.

KNIFE GRINDING MACHINERY
Machinery Co. of America, Big Rapids, Mich.

LINE SHAFT BEARINGS
The Hill Clutch Co., Cleveland, Ohio.

MACHINE DRYER TEMP. CONTROL
Open Coil Heater and Purifier Co., Indianapolis, Ind.
Valley Iron Works, Appleton, Wis.

MECHANICAL PULP
J. Andersen & Co., 21 E. 40th St., New York City.
Hart Trading Co., Inc., Tribune Bldg., New York City.
E. B. Thomas & Co., Inc., 100 Hudson St., New York City.

MECHANICAL STOKERS
Sanford Riley Stoker Co., Worcester, Mass.

OIL HANDLING AND STORING EQUIPMENT
The Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

PAPER BOARDS
The C. L. La Boiteaux Co., 200 Fifth Ave., N. Y.
F. D. Wilson, 1520 Lumber Exchange Building, Chicago, Ill.

PAPER DISTRIBUTORS
Bermingham and Prosser, Chicago, Ill.
Seaman Paper Co., Chicago, Ill.

PAPER EXPORTERS AND IMPORTERS
American Transmarine Co., 13 Park Row, New York City.
Gatti-McQuade Co., 200 Filth Ave., New York City.
Hart Trading Co., Inc., Tribune Bldg., New York City.
E. J. Keller Company, 200 Fifth Ave., N. Y. C.
Main Paper Stock Co., 23-31 Peck Slip, New York City.

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Equipment, Apparatus, Supplies and Raw Materials Used by the Paper Industry

New York Overseas Co., 17 Battery Place, New York City.
Storm & Bull, 2 Rector St., New York City.
E. B. Thomas & Co., Inc., 100 Hudson St., New York City.
Interstate Pulp and Paper Co., Grand Central Bldg., New York City.
Lagerloef Trading Co., 18 E. 41st St., N. Y. C.
Parsons Trading Co., 17 Battery Place, N. Y. C.

PAPER MACHINES
Beloit Iron Works, Beloit, Wis.
The Black-Clawson Co., Hamilton, Ohio.

PAPER MANUFACTURERS
American Writing Paper Co., Holyoke, Mass.
Bardeen Paper Co., Otsego, Mich.
Bogalusa Paper Co., Inc., Bogalusa, La.
Bryant Paper Co., Kalamazoo, Mich.
Continental Paper Bag Co., New York City.
Detroit Sulphite & Paper Co., Detroit, Mich.
Hammermill Paper Co., Erie, Pa.
Howard Paper Co., Urbana, O.
Lakeside Paper Co., Neenah, Wis.
Marathon Paper Co., Rothschild, Wis.
Monarch Paper Co., Kalamazoo, Mich.
Munising Paper Co., Munising, Mich.
Nekoosa-Edwards Co., Nekoosa, Wis.
Northern Paper Mills, Green Bay, Wis.
Oxford Paper Co., 200 Fifth Ave., N. Y. City.
Rex Paper Co., Kalamazoo, Mich.
Ticonderoga Pulp & Paper Co., 200 Fifth Ave., New York City.
Watervliet Paper Co., Watervliet, Mich.
Wausau Sulphate Fibre Co., Mosinee, Wis.
Wolverine Paper Co., Otsego, Mich.

PAPER MANUFACTURERS' SUPPLIES
J. Andersen & Co., 21 East 40th St., New York City.
Robert Blank, 140 Nassau St., New York City.
Francis Hughes Co., 21st St. and Loomis Ave., Chicago.
E. J. Keller Company, 200 Fifth Ave., N. Y. C.
Gatti-McQuade Co., 200 Rifth Ave., New York City.
Martin Spinelli, 132 Nassau St., New York City.
Main Paper Stock Co., 25-31 Peck Slip, New York City.
Mendelson Bros. Paper Stock Co., 910 Michigan Ave., Chicago.
New York Overseas Co., Inc., 17 Battery Place, New York City.
Salomon Bros. & Co., 200 Fifth Ave., N. Y. C.
E. B. Thomas & Co., Inc., 100 Hudson St., New York City.
Vito G. Cantasano & Bros., 185 South St., New York City.

PAPER MILL BROKERS
Gibbs-Brower Co., 261 Broadway, N. Y. C.

PAPER STOCK CUTTERS
Taylor, Stiles & Co., Riegelsville, N. J.

PAPER AND PULP MILL MACHINERY
The Sandy Hill Iron & Brass Works, Hudson Falls, N. Y.

PAPER TESTERS
B. F. Perkins and Son, Inc., Holyoke, Mass.
The Widney Co., Chicago, Ill.

PARCHMENT MANUFACTURERS
Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich.
Sutherland Paper Co., Kalamazoo, Mich.

POWER TRANSMISSION
F. L. Smidth & Co., 50 Church St., N. Y. C.
The Hill Clutch Co., Cleveland, Ohio.

PRINTERS' ROLLERS
American Printers' Roller Co., 316 West Grand Ave., Chicago, Ill.

PULP (Chemical)
American Transmarine Co., 13 Park Row, New York City.
J. Andersen & Co., 21 East 40th St., New York City.
Eastern Manufacturing Co., 501 Fifth Ave., New York City.
Hart Trading Co., Inc., Tribune Bldg., New York City.
Daniel M. Hicks, 140 Nassau St., New York City.
E. J. Keller Company, 200 Fifth Ave., N. Y. C.
New York Overseas Co., Inc., 17 Battery Place, New York City.
Price & Pierce, Ltd., 30 East 42nd St., New York City.
The Pulp & Paper Trading Co., 21 East 40th St., New York City.
Scandinavian-American Trading Co., 50 East 42d St., New York City.
Lagerloef Trading Co., 18 E. 41st St., N. Y. C.
Perkins-Goodwin Co., 33 W. 42nd St., N. Y. C.

PULP (Mechanical)
Perkins-Goodwin Co., 33 W. 42nd St., N. Y. C.

PULP EXTRACTORS
The Griley-Unkle Eng. Co., Ft. Wayne, Ind.

PULP AND PAPER MACHINERY
Beloit Iron Works, Beloit, Wis.
Moore & White Co., Philadelphia, Pa.
Valley Iron Works, Appleton, Wis.
The Black-Clawson Co., Hamilton, Ohio.

PULP WASHERS
The Green Bay Foundry and Machine Co. Green Bay, Wis.

PUMPS (Paper)
Buffalo Steam Pump Co., Buffalo, N. Y.
Dean Bros., Indianapolis, Ind.

PUMPS (Vacuum)
American Steam Pump Co., Battle Creek, Mich
Buffalo Foundry and Machine Co., Buffalo, N. Y
Thos. H. Savery, Republic Bldg., Chicago, Ill.
Dean Bros., Indianapolis, Ind.

RAG AND PAPER DUSTERS
Holyoke Machine Co., Holyoke, Mass.

RESPIRATORS
National Appliance Co., Elgin, Ill.

ROTARY VACUUM PUMPS
Sandusky Foundry & Machine Co., Sandusky, O.

RUBBER ROLLS
United States Rubber Co., New York and Chicago

ROLL GRINDING
Bevis & Shartle Mch. Co., Middletown, O.

ROLL WRAPPING MACHINES:
Nekoosa Motor & Machine Co., Nekoosa, Wis.

ROTARY SCREEN
Thos. H. Savery, Republic Bldg., Chicago, Ill

SAVE-ALLS
The Green Bay Foundry and Machine Co., Green Bay, Wis.

SAWS
Simonds Manufacturing Co. Fitchburg, Mass.

SCREEN PLATES
Central Mfg. Co., Kalamazoo, Mich.
Union Screen Plate Co., Fitchburg, Mass.
William A. Hardy & Sons, Fitchburg, Mass.

SCREEN DIAPHRAGMS
United States Rubber Co., Chicago, Ill.

SHOWER PIPES
Sandusky Foundry and Machine Co., Sandusky, Ohio.

SILENT CHAIN DRIVES
The Link Belt Co., Chicago, Ill.

SLITTING AND REWINDING MACHINERY
Cameron Machine Co., Brooklyn, N. Y.

SPEED CHANGES
Moore and White Co., Philadelphia, Pa.

STEAM JET CONVEYORS
American Steam Conveyor Corp., Chicago, Ill.

STOCK CIRCULATING SYSTEM
Claflin Engineering Co., Lancaster, Ohio.
Ticonderoga Machine Works, Ticonderoga, N.Y.

STOCK PUMPS
Buffalo Steam Pump Co., Buffalo, N. Y.

STOCK SHREDDER
The Green Bay Foundry and Machine Co., Green Bay, Wis.

SUCTION ROLLS
Sandusky Foundry and Machine Co., Sandusky, Ohio.

SULPHUR
Union Sulphur Co., 17 Battery Place, New York City.

SULPHUR BURNERS
Valley Iron Works Co., Appleton, Wis.

TIERING MACHINES
Economy Engineering Co., Chicago, Ill.
Lakewood Mfg. Co., Cleveland, Ohio.

TURBINES (Water)
James Leffel and Co., Springfield, Ohio.

TURBINES (Hydraulic)
S. Morgan Smith Co., York, Pa.

VACUUM SYSTEMS
Open Coil Heater and Purifier Co., Indianapolis, Ind.

VALVES
The Crane Co., Chicago, Ill.
G. M. Davis Regulator Co., 414 Milwaukee Ave., Chicago, Ill.
The Wm. Powell Co., Cincinnati, Ohio.
Voorhees Rubber Mfg. Co., Jersey City, N. J.

VARIABLE SPEED ENGINES
Ball Engine Co., Erie, Pa.
The Brownell Co., Dayton, Ohio.
Chandler and Taylor, Indianapolis, Ind.
Erie Engine Works, Erie, Pa.
Hooven, Owens, Rentschler Co., Hamilton, O.

VENTILATING SYSTEMS
Bayley Mfg. Co., 732 Greenbush St., Milwaukee, Wis.
Buffalo Steam Pump Co., Buffalo, N. Y.
B. F. Perkins and Son, Inc., Holyoke, Mass.

WASHER WIRES
The W. S. Tyler Co., Cleveland, Ohio.

WASTE PAPER STOCK
Gatti-McQuade Co., 200 Fifth Ave., New York City.
Francis Hughes Co., 21st and Loomis Street, Chicago.
Main Paper Stock Co., 23-31 Peck Slip, New York City.
F. G. Marquardt, Inc., 345 Broadway, N. Y. C.
Martin Spinelli, 132 Nassau St., New York City.
Mendelson Bros. Paper Stock Co., 910 S. Michigan Blvd., Chicago, Ill.
E. B. Thomas & Co., Inc., 100 Hudson St., New York City.
Salomon Bros. & Co., 200 Fifth Ave., N. Y. C.

WATER FILTER
The Green Bay Foundry and Machine Co., Green Bay, Wis.

WATER HEATERS:
The Sims Co., Erie, Pa.

WATERPROOF LINING
The National Waterproofing Co., Philadelphia, Pa.

WATER-SOFTENING AND PURIFYING SYSTEMS
Wm. Graver Tank Works, East Chicago, Ind.
Wm. B. Scaife and Sons Co., Oakmont, Pa.

WATER WHEELS
James Leffel and Co., Springfield, Ohio.
Holyoke Machine Co., Holyoke, Mass.

WET MACHINES
Valley Iron Works Co., Appleton, Wis.

WIRE SIGNS
Cheney Bigelow Wire Works, Springfield, Mass.

WRAPPING MACHINES
Nekoosa Motor and Machine Co., Nekoosa, Wis.

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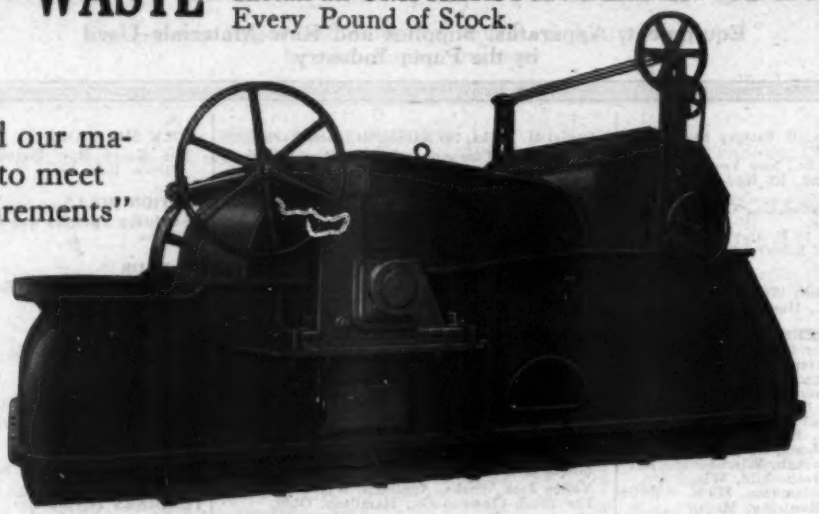

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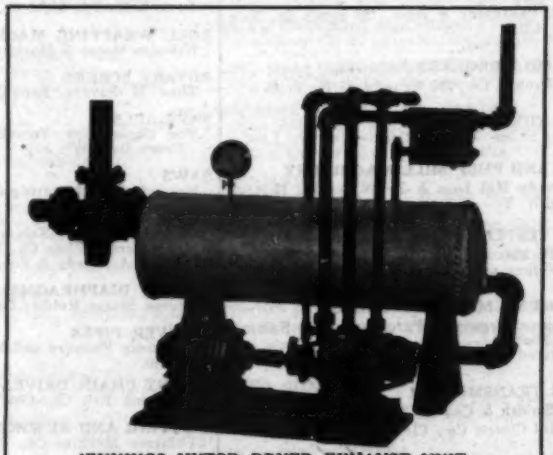

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Marathon Paper Co., Rothschild, Wis. 807
Marquardt, Inc., F. G., 345 Broadway, N. Y. C. 934
Mendelson Bros. Paper Stock Co., 910 Michigan Blvd., Chicago 928
Miner-Edgar Co., 30 Church St., N. Y. C. 934
Monarch Paper Co., Kalamazoo, Mich. 814
Moore & White Co., Philadelphia, Pa. Front Cover
Munising Paper Co., Munising, Mich. 814
National Waterproofing Co., Philadelphia, Pa. 936
National Appliance Co., Elgin, Ill. 888
Nekoosa-Edwards Paper Co., Nekoosa, Wis. 811
Nekoosa Motor & Machine Co., Nekoosa, Wis. 940
New York Overseas Co., 17 Battery Place 830
Northern Engineering Works, Detroit, Mich. 934
Northern Paper Mills, Green Bay, Wis. 915
Numan, H. O., Green Bay, Wis. 900
Open Coil Heater and Purifier Co., Indianapolis, Ind. 885
Oxford Paper Co., 200 Fifth Ave. 931
Oliver Bros., 99 Warren St., N. Y. C. 935
Parsons Trading Co., 17 Battery Place, N. Y. C. 902
Perkins-Goodwin Co., 33 W. 32nd St., N. Y. C. 832 & 833
Perkins & Son, Inc., B. F., Holyoke, Mass. 912
Powell Co., The, Wm., Cincinnati, O. 934
Pulp & Paper Trading Co., 21 E. 40th St., N. Y. C. 936
Price & Pierce, 30 E. 42nd St., N. Y. C. 932
Portable Machine Co., Passaic, N. J. 884
Premier Shipping Co., 32 Broadway, N. Y. C. 935
Russ Company, E. F., 201 Devonshire St., Boston, Mass. 903
Salomon Bros. & Co., 200 Fifth Ave., N. Y. C. 932
Sandy Hill Iron & Brass Works, Hudson Falls, N. Y. 946
Sanford-Riley Stoker Co., Worcester, Mass. 914
Sandusky Foundry & Machine Co., Sandusky, Ohio. 893
Savery, Thos. H., Republic Bldg., Chicago, Ill. 944
Scaife & Sons Co., Wm. B., Oakmont, Pa. 909
Scandinavian American Trading Co., 50 E. 42nd St., N. Y. C. 932
Seaman Paper Co., Chicago, Ill. 808
Shuler & Benninghofen, Hamilton, Ohio 892
Signode System, Chicago, Ill. 892
Sims Co., The, Erie, Pa. 940
Simonds Manufacturing Co., Fitchburg, Mass. 908
Spinelli, Martin, 132 Nassau St., N. Y. C. 819 & 820
Smidth & Co., F. L., 50 Church St., N. Y. C. 907
Smith, S., Morgan Co., York, Pa. 939
Storm & Bull, 2 Rector St., N. Y. C. 909
Stuebing Truck Co., Cincinnati, O. 829
Sutherland Paper Co., Kalamazoo, Mich. 890
Swenson Evaporator Co., Chicago, Ill. 939
Taylor Styles & Co., Riegelsville, N. J. 925
Thomas, E. B., Co., New York City. 911
Ticonderoga Machine Works, Ticonderoga, N. Y. 900
Tyler, W. S., & Co., Cleveland, Ohio 917
Union Screen Plate Co., Fitchburg, Mass. 935
Union Sulphur Co., 17 Battery Place, N. Y. C. 896
United States Rubber Co., New York 821
United States Cast Iron Pipe Co., Pittsburgh, Pa. 926
Valley Iron Works Co., Appleton, Wis. Back Cover
Voorhees Rubber Co., Jersey City, N. J. 941
Watervliet Paper Co., Watervliet, Mich. 806
Wausau Sulphate Fibre Co., Mosinee, Wis. 922
Widney Co., The, Chicago, Ill. 931
Wilson, F. D., 1520 Lumber Exchange Bldg., Chicago, Ill. 946
Wisconsin Wire Works, Appleton, Wis. 935
Wolverine Paper Co., Otsego, Mich. 894
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind. 809

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